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SOME FACTORS INFLUENCING, IN VIVO, THE RESULT OF THE GLOBULIN PRECIPITATION TEST

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In the early history of the globulin precipitation test as inaugurated by Klausner the explanation for the occurrence of a precipitate in a fresh serum upon dilution with distilled water was given by that author. It was claimed that the precipitable substance is a globulin. It was maintained by Klausner[2] that this reaction is different in its nature from the Wassermann reaction, in as much as it occurs in the early stage of syphilis a long time before the Wassermann reaction becomes positive. In 1924 Schöbl and Basaca[3] showed that the globulin precipitation reaction was positive in 100 per cent of lepers examined. Furthermore, Schöbl and Ramirez[4] found that this reaction is positive in yaws, in which disease, as in syphilis, the globulin reaction precedes the Wassermann reaction; and, after thorough specific treatment of cases of yaws, when the Wassermann reaction has become negative, the globulin precipitation reaction persists, particularly in patients who show residual symptoms such as intumescence of lymphatic glands. In that respect the globulin reaction, although not specific, is an anamnestic reaction. During the study of serology of yaws Schöbl and Ramirez[4] proved experimentally that the precipitate which forms from fresh frambœsic serum, upon dilution with distilled water, is not the carrier of the Wassermann antibody. It has been shown that the precipitate is insoluble in water, that it gives a characteristic reaction for protein, and is soluble in any concentration of sodium chloride. From these findings a conclusion was drawn by these authors that the balance between salts and globulins in the positive sera is upset.

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[1] Lieutenant Surgeon, Imperial Japanese Navy.

[2] Wiener Klin. Wochenschr. 21 (1908) 214, 363, and 940.

[3] Philip. Journ. Sci. 25 (1924) 1.

[4] Philip. Journ. Sci. 30 (1926) 483.

It remained to demonstrate experimentally how far the result of this precipitation test is influenced by the increase or decrease of protein substance in the circulating blood or by the increase or decrease of concentration of salts contained in the circulating blood. Experiments were arranged on rabbits, therefore, in such a way that their sera were subjected to this test before and after the injection of a foreign protein and of hypertonic and hypotonic salt solution. The details of the experiments are given in the tables forming a part of this paper.

DESCRIPTION OF TECHNIC

About 5 cubic centimeters of blood were withdrawn from the heart of the animal to be examined, by means of a sterilized syringe which was thoroughly washed with a sterilized physiologic salt solution to prevent hæmolysis.

The blood was placed in a sterilized test tube which was moistened with sterilized salt solution; it was allowed to stand until the serum separated.

Only absolutely clear sera were used.

Five small test tubes for each blood specimen were arranged in a rack. One Wright's pipette marked to contain 0.2 cubic centimeter, and another one marked to contain 0.6 cubic centimeter, were rinsed with distilled water three times and dried.

Two-tenths cubic centimeter of the fresh serum of the animal was placed in each tube by means of the 0.2 cubic centimeter Wright's pipette.

Distilled water was added to the five tubes from 1 to 5, in increasing amounts, to represent final dilutions of 1:1, 1:2, 1:3, 1:4, and 1:5.

Each tube was then revolved around its axis so as to mix the serum and the distilled water thoroughly.

The same dilutions of serum as described above were duplicated, using physiologic salt solution instead of distilled water.

The tubes were allowed to stand at room temperature (about 28° C.) for two hours. They were then placed in the refrigerator; the result was read and recorded the next morning.

DISCUSSION OF EXPERIMENTS

Animal 1 was tested by the globulin precipitation test (see Table 1); in none of the dilutions (1: 1, 1: 2, 1: 3, 1: 4, 1: 5) did precipitation, either with salt solution or with distilled water, take place. The animal then received intravenously 10 cubic centimeters of hypotonic salt solution. Blood was withdrawn from the heart of the animal and the clear serum gave precipitation in dilution with distilled water, but not with physiologic salt solution. The next day the animal received 10 cubic centimeters of normal horse serum per venam. It was bled again and its serum gave positive precipitation reaction in all dilutions, both with distilled water and with salt solution. Six days after the injection of horse serum a precipitate was still noticeable with animal serum in dilutions 1: 2, 1: 3, 1: 4, and 1: 5 with distilled water, but no precipitation occurred upon dilution with salt solution. Two weeks after the injection of horse serum per venam, the serum of the same animal gave a faint precipitate in dilutions 1: 1 and 1: 2, and distinct precipitate in dilutions 1: 3, 1: 4, and 1: 5; a trace of precipitate was noticeable in dilutions 1: 4 and 1: 5 with salt solution. Immediately after the injection of 10 cubic centimeters of 10 per cent salt solution the serum of the animal gave a negative result, as far as the precipitation is concerned, in all dilutions with physiologic salt solution as well as with distilled water.

Experiments on rabbits 2, 3, and 5, as evident from Tables 2, 3, and 4, are practically a duplication of the first experiment, the only difference being that rabbit 5 was injected with horse serum inspissated to one-fourth of the original volume. Although the results with these three rabbits vary somewhat quantitatively, it is evident that the effect upon the result of the test of the increase or decrease of the salt on the one hand, and of the protein on the other hand, was in the same direction. It is further evident that the balance of the salts and protein in the circulating blood, upset by the dilution or high concentration of salts, rectified itself far more quickly than was the case when the concentration of the protein was increased by the injection of protein solution—that is, horse serum. It stands to reason that a small molecular salt solution will be eliminated more quickly than will the large molecular protein.

In the next experiment (see Tables 5 and 8) the influence of feeding and starvation upon the result of the globulin precipitation test was studied. The animals were starved twenty-four or forty-eight hours and the test was performed at the end of the starvation period. They were then allowed to feed and were tested again. The feeding had apparently no effect upon the result of the globulin precipitation test. The food consisted of grass and oats. It was to be expected that the small amount of protein contained in this kind of food would have little effect upon the result of the test in an herbivorous animal.

Other factors were studied which may, theoretically speaking, be expected to have a possible influence upon the result of the globulin precipitation test. The factors of narcosis (Table 6) and of intraperitoneal injection (Table 7) of a large amount of physiologic salt solution, as well as of repeated bleeding were studied (Table 9). It can be seen from the tables that the effect of narcosis with ether was nil in rabbits. Intraperitoneal injection, however, very likely due to the early exudation of the liquid portion of the blood into the peritoneum, influenced the reaction distinctly in such a way that positive precipitation was noticed in a lower dilution of fresh serum six hours after intraperitoneal injection than immediately before the injection.

Rabbits 1 and 2 (Table 7) were examined before and after intraperitoneal injection of 20 cubic centimeters of physiologic salt solution. Six hours after the injection the result of the reaction was the shifting of the precipitation toward the end of higher concentration.

Rabbit 7 (Table 8) was fed 10 cubic centimeters of horse serum. The globulin precipitation test of the rabbit serum was performed two hours before and after feeding. The result was the same in both examinations. The same experiment was applied to rabbit 8. The serum of this animal gave a positive reaction before feeding but a negative reaction six hours after feeding of 10 cubic centimeters of horse serum. Twenty-four hours and seventy-two hours after feeding, the serum of this animal gave a positive reaction.

In the next experiment (Table 9) the influence of successive bleeding upon the globulin reaction was investigated. Rabbits 10, 11, and 12 were bled 4 cubic centimeters of blood each, three times at intervals of five hours and twenty-four hours, respectively. The sera of all three of these rabbits gave a negative reaction on the first bleeding. On the examination of the second bleeding, rabbit 10 gave a negative reaction in all dilutions, but rabbit 11 gave a positive reaction in the dilutions 1: 3, 1: 4, and 1: 5, and rabbit 12 gave the same reaction in dilutions 1: 2 to 1: 5. On the third bleeding the sera of all of these animals gave a positive result in all the dilutions.

CONCLUSIONS

1. The decrease in concentration of salts in the circulating blood causes the globulin precipitation reaction to become stronger.
2. The increase in concentration of salts in the circulating blood brings about a weaker or a completely negative result.
3. The increase of protein in the circulating blood has as a consequence a very strongly positive globulin precipitation reaction.
4. The influence upon the result of the reaction of the increased protein content in the circulating blood can be detected for a much longer time than can the effect upon the reaction of the increased or decreased salt content in the circulating blood.
5. The influence of general anæsthesia, starving, and feeding upon the result of the reaction in herbivorous animals is not perceptible. Exudation, however, into serous cavities produces increase in strength of the globulin precipitation reaction.
6. The administration, as a food, of protein by mouth to herbivorous animals does not influence the result of globulin reaction.
7. Repeated bleeding at relatively short intervals also influences the result of the reaction in a positive direction.

ACKNOWLEDGMENT

Thanks are due to Dr. Otto Schöbl, of the division of biology and serum laboratory, Bureau of Science, for valuable assistance in carrying out this work.

TABLE 1.—*Showing the result of the globulin precipitation test in rabbit 1.*

		Dilution of serum.				
		1:1	1:2	1:3	1:4	1:5
Before injection	H_2O	—	—	—	—	—
	Ph.S.S.[a]	—	—	—	—	—
After injection per venam of 10 cc hypotonic (0.45 per cent) NaCl, July 14	H_2O	±	+	+	+	+
	Ph.S.S	—	—	—	—	—
After injection of 10 cc normal horse serum, July 15	H_2O	±	+	+	+	+
	Ph.S.S.	±	+	+	+	+
Six days after injection of horse serum, July 21	H_2O	—	+	±	±	+
	Ph.S.S.	—	—	—	—	—
Two weeks after injection of horse serum, July 29	H_2O	±	±	+	+	+
	Ph.S.S.	—	—	—	±	±
Before injection, July 31	H_2O	—	—	+	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 per cent NaCl	H_2O	—	—	—	—	—
	Ph.S.S.	—	—	—	—	—

[a] Physiologic salt solution.

TABLE 2.—*Showing the result of the globulin precipitation test in rabbit 2.*

		Dilution of serum.				
		1:1	1:2	1:3	1:4	1:5
Before injection, July 16	H_2O	—	—	±	+	+
	Ph.S.S.	—	—	±	±	±
After injection of 10 cc of 0.45 per cent NaCl solution, July 21	H_2O	—	±	±	+	+
	Ph.S.S.	—	—	—	—	—
Before injection of horse serum, July 22	H_2O	—	—	—	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 cc horse serum	H_2O	±	+	+	+	+
	Ph.S.S.	—	—	±	±	±
Six days after injection of horse serum, July 29	H_2O	+	+	+	+	+
	Ph.S.S.	±	+	+	+	+
Before injection, July 31	H_2O	—	±	±	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 cc of 10 per cent NaCl, July 31	H_2O	—	—	—	±	±
	Ph.S.S.	—	—	—	—	—

TABLE 3.—*Showing the result of the globulin precipitation test in rabbit 3.*

		Dilution of serum.				
		1:1	1:2	1:3	1:4	1:5
Immediately after injection 0.45 per cent NaCl, July 22	H_2O	—	—	+	+	+
	Ph.S.S.	—	—	—	—	—
Before injection of 10 cc of horse serum, July 23	H_2O	—	—	+	+	+
	Ph.S.S.	—	—	—	—	—
Twenty-four hours after injection of 10 cc of horse serum, July 24	H_2O	—	—	—	±	±
	Ph.S.S.	—	—	—	—	—
Seven days after injection of 10 cc of horse serum, July 31	H_2O	—	+	+	+	+
	Ph.S.S.	—	—	—	—	±
Immediately after injection of 10 cc of 10 per cent NaCl	H_2O	—	—	±	±	±
	Ph.S.S.	—	—	—	—	—

TABLE 4.—*Showing the result of the globulin precipitation test in rabbit 5.*

		Dilution of serum.				
		1:1	1:2	1:3	1:4	1:5
Before injection of 10 per cent NaCl, July 24	H_2O	—	+	+	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 cc of 10 per cent NaCl, July 27	H_2O	—	—	—	—	—
	Ph.S.S.	—	—	—	—	—
Four days after injection of 10 per cent NaCl, July 31	H_2O	—	±	±	+	+
	Ph.S.S.	—	—	—	—	—
Immediately after injection of 10 cc of concentrated horse serum August 5 [a]	H_2O	±	+	+	±	—
	Ph.S.S.	—	+	+	+	+

[a] About 40 cubic centimeters of horse serum were placed forty-eight hours in a desiccator which was connected with a vacuum, and concentrated to the amount of about 5 cubic centimeters, and then 10 cubic centimeters of distilled water were added to make the serum liquid. As the concentrated serum was flaky, it was filtered through cotton by means of a sterilized funnel and 11 cubic centimeters of filtrate were obtained.

TABLE 5.—*Showing the result of the globulin precipitation test before and after feeding.*

Rabbit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
1	Before feeding, after starving twenty-four hours	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
1	Immediately after feeding, after starving twenty-four hours	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—
2	Before feeding, after starving two days	H_2O	—	—	+	±	±
		Ph.S.S.	—	—	—	—	—
2	Immediately after feeding	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—
3	Before feeding, after starving two days	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—
3	Immediately after feeding	H_2O	—	—	+	+	+
		Ph.S.S.	—	—	—	—	—

TABLE 6.—*Showing the result of the globulin precipitation test before and after narcosis.*

Rabbit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
1	Before narcosis	H_2O	±	+	+	+	+
		Ph.S.S.	—	—	—	—	—
1	Immediately after narcosis (ether)	H_2O	—	±	±	±	±
		Ph.S.S.	—	—	—	—	—
2	Before narcosis	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
2	Immediately after narcosis (ether)	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
3	Before narcosis	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
3	Immediately after narcosis (ether)	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
6	Before narcosis	H_2O	—	—	±	+	+
		Ph.S.S.	—	—	—	—	—
6	Immediately after narcosis (ether)	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—

TABLE 7.—*Showing the result of the globulin precipitation test before and after intraperitoneal injection of 20 cubic centimeters of physiologic salt solution.*

Rabbit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
1	Before injection	H_2O	—	—	±	+	+
		Ph.S.S.	—	—	—	—	—
1	Six hours after injection of 20 cc Ph.S.S. intraperitoneally	H_2O	±	±	+	+	+
		Ph.S.S.	—	—	—	±	±
2	Before injection	H_2O	—	—	—	±	+
		Ph.S.S.	—	—	—	—	—
2	Six hours after injection of 20 cc Ph.S.S. intraperitoneally	H_2O	—	±	+	+	+
		Ph.S.S.	—	—	—	—	—

TABLE 8.—*Showing the result of the globulin precipitation test before and after feeding with 10 cubic centimeters of horse serum.*

Rabbit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
7	Before feeding	H_2O	—	—	+	+	+
		Ph.S.S.	—	—	—	—	—
7	Two hours after feeding with 10 cc of horse serum	H_2O	—	—	+	+	+
		Ph.S.S.	—	—	—	—	—
8	Before feeding	H_2O	+	+	+	+	+
		Ph.S.S.	—	—	—	—	—
8	Six hours after feeding with 10 cc of horse serum	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
8	Twenty-four hours after feeding with horse serum	H_2O	+	+	+	+	+
		Ph.S.S.	—	—	—	—	—
8	Seventy-two hours after feeding with horse serum	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—

TABLE 9.—*Showing the result of the globulin precipitation test after repeated bleeding.*

Rabit No.	Remarks.		Dilution of serum.				
			1:1	1:2	1:3	1:4	1:5
10	First bleeding, 8 a. m., March 29	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
10	Second bleeding, 1 p. m., March 29	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
10	Third bleeding, 8 a. m., March 30	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
11	First bleeding, 8 a. m., March 29	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
11	Second bleeding, 1 p. m., March 29	H_2O	—	—	±	+	+
		Ph.S.S.	—	—	—	—	—
11	Third bleeding, 8 a. m., March 30	H_2O	+	+	+	+	+
		Ph.S.S.	—	—	—	—	—
12	First bleeding, 8 a. m., March 29	H_2O	—	—	—	—	—
		Ph.S.S.	—	—	—	—	—
12	Second bleeding, 1 p. m., March 29	H_2O	—	+	+	+	+
		Ph.S.S.	—	—	—	—	—
12	Third bleeding, 8 a. m., March 30	H_2O	+	+	+	+	+
		Ph.S.S.	—	—	—	—	—

SALTS OF LINOLENIC HEXABROMIDE FROM LUMBANG OIL

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The glycerides of linolenic, linolic, and oleic acids occur naturally in vegetable drying oils. These unsaturated glycerides, particularly linolenic and linolic, are the substances that absorb oxygen from the air and cause the oil to dry.

The commercial value of an oil suitable for the manufacture of paint and varnish depends on its drying power, which is really the oxygen-absorbing capacity of the particular unsaturated compounds contained in the oil. Previous experiments[1] carried out on the oxidation of Philippine lumbang oil showed that linolenic glyceride was oxidized more readily than was linolic glyceride; also, the latter absorbed oxygen more rapidly than did oleic glyceride.

Linolenic glyceride has a greater capacity for the absorption of oxygen than has any of the other compounds contained in drying oils. This glyceride and the corresponding free linolenic acid are, therefore, substances of considerable importance, since the amount of this glyceride present in a drying oil determines to a considerable extent the commercial value of the oil.

Although linolenic glyceride and the free linolenic acid are substances which oxidize readily, they may be separated from an oil in the form of a stable hexabromide.[2] Since this linolenic hexabromide (hexabrom stearic acid) is a stable form of linolenic compounds, it is an important substance in the chemistry of vegetable drying oils. Only a very few derivatives of this substance (hexabromide) have ever been prepared. Erdmann and Bedford[3] state that they prepared the potassium and barium salts of the hexabromide and also the methyl and ethyl esters, but they do not give the experimental details. Nor do they give the melting point or analysis of the salts.

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[1] West, A. P., and A. I. De Leon, Philip. Journ. Sci. 24 (1924) 123; Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 2 (1922) 42.

[2] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 212.

In view of the fact that very little is known about linolenic hexabromide we thought it might be of interest to make a few salts of this substance and determine their solubility in various organic solvents. The data thus obtained may be useful in devising new methods of analysis and in working out more-accurate separations of mixtures of halogen stearic acids, such as linolenic hexabromide, linolic tetrabromide, and oleic dibromide.

In order to study the chemical behavior of the unsaturated acids (which occur as glycerides in drying oils), or to make pure derivatives of these acids, it is necessary to separate each individual acid from the mixture of substances contained in the oil. The method commonly used is to decompose the glycerides and convert them into a mixture of free unsaturated acids. Since the unsaturated acids absorb oxygen readily when exposed to the air, they are treated with bromine and converted into the mixed bromo addition products[4] (linolenic hexabromide, linolic tetrabromide, and oleic dibromide). The mixed bromides are very stable substances. Both the hexabromide and the tetrabromide may be separated from the dibromide and from each other by treatment with solvents, and they may be converted back again into the free acids by reduction[5] with zinc in alcoholic solution. Thus it is possible experimentally to separate from an oil, such as lumbang, individual unsaturated acids and to study the chemistry of these acids and their derivatives.

EXPERIMENTAL PROCEDURE

In preparing a supply of linolenic acid hexabromide for our experiments, we used Philippine lumbang oil, which is a drying oil used in making paints, varnishes, and similar products.[6] The lumbang oil we used was pressed from nuts of good quality and filtered first through glass wool and then through filter paper. Lumbang oil consists almost entirely of glycerides[7] of the unsaturated acids, linolenic, linolic, and oleic. It serves as excellent material for preparing linolenic and linolic acids and their derivatives. When lumbang oil is decomposed and the glycerides are converted into mixed unsaturated acids and these mixed acids brominated in ether solution, linolenic hexabromide is precipitated according to the following equation:

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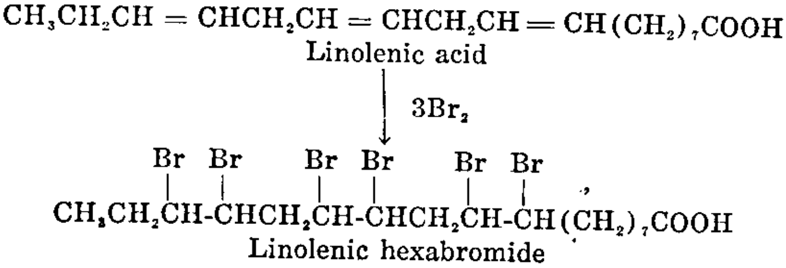
[3] Ber. Deut. Chem. Gesell. 42 (1909) 1324.

[4] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 585.

[5] Ibid 1 (1921) 201, 202, and 210.

[6] West, A. P., and F. L. Smith, Bull. P. I. Bur. Forestry 24 (1923).



$$CH_3CH_2CH = CHCH_2CH = CHCH_2CH = CH(CH_2)_7COOH$$

Linolenic acid

$$\downarrow 3Br_2$$

$$CH_3CH_2\overset{Br}{CH}\text{-}\overset{Br}{C}HCH_2\overset{Br}{CH}\text{-}\overset{Br}{C}HCH_2\overset{Br}{CH}\text{-}\overset{Br}{CH}(CH_2)_7COOH$$

Linolenic hexabromide

Linolenic acid hexabromide.—Freshly prepared lumbang oil was saponified with aldehyde-free alcoholic potassium hydroxide in batches of 530 grams each. The resulting soaps were converted into mixed unsaturated acids which were extracted with ether and the ether solution was dehydrated with sodium sulphate. The ethereal solution of mixed acids, containing about 500 grams of acids, was poured into a 5-liter flask and diluted with redistilled ether to a volume of 4 liters. The flask containing the acids was immersed in a freezing bath of ice, salt, and water. The solution of mixed acids was stirred mechanically by means of a hot-air motor, and brominated according to the method of Eibner and Muggenthaler.[8] When the thermometer immersed in the acid solution registered —10° C. or below, a slight excess of the calculated quantity of bromine (135.3 cubic centimeters of specific gravity 3.12) was allowed to drop rather rapidly into the acid solution from a dropping funnel, the end of which was drawn out to a rather fine opening. The temperature of the acid solution was not allowed to rise above —5° C. In about three hours the required amount of bromine was added to the acid solution. To complete the reaction the mixture was allowed to remain in the ice bath and the stirring continued for about two hours longer. The reaction product was then filtered to separate the insoluble hexabromide. The hexabromide was washed thoroughly with ether until white and then dried on layers of filter paper.

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[7] West, A. P., and Z. Montes, Philip. Journ. Sci. 18 (1921) 619.

[8] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 585.

When the unsaturated acids of lumbang oil are brominated at a low temperature, and especially in dilute solution, sticky products are not formed so readily as when the bromination is carried out in a more concentrated solution. It is also advisable to use a very slight excess of bromine, so that when the reaction is complete the mixture has a slightly yellow color. Incomplete bromination usually gives a reaction product that is somewhat oily and does not filter well.

To purify the linolenic hexabromide, samples of about 40 grams were washed thoroughly with ether, after which the hexabromide was crystallized, in small portions, first from ethyl acetate and then from benzene. After each crystallization the acid was filtered through a Buchner funnel with the aid of a partial vacuum and then washed well with ether, dried, and powdered. After standing in a vacuum desiccator for some hours the melting point was determined and found to be 179.5° C. to 180.5° C.

The acid was analyzed by determining the bromine content. This was done by boiling about 0.1 gram of the substance with a concentrated aqueous solution of silver nitrate (containing about 0.5 gram of silver nitrate) and 30 cubic centimeters of pure concentrated nitric acid. The precipitated silver bromide was collected on a Gooch crucible.

Analysis of linolenic hexabromide.

[0.1388 gram of sample gave 0.2078 gram silver bromide.]

	Bromine. Per cent.
Calculated for $C_{18}H_{30}Br_6O_2$	63.27
Found	63.71

In endeavoring to make derivatives of linolenic hexabromide, considerable difficulty was experienced, because the acid is rather insoluble in the ordinary organic solvents and it is necessary to work with very dilute solutions. Linolenic hexabromide does, however, dissolve to a certain extent in various solvents such as benzene, benzyl alcohol, ethyl acetate, xylene, pyridine, and the propyl and butyl alcohols.

Salts of linolenic hexabromide were prepared by first converting the acid into the potassium salt. A methyl alcohol solution of the potassium salt was then treated with a methyl alcohol solution of an inorganic salt such as barium bromide. The precipitated salt thus obtained was purified and the melting point and solubility in various solvents were determined. The lead salt was, however, prepared directly from the free linolenic hexabromide.

Potassium salt of linolenic hexabromide.—Ten grams of linolenic hexabromide were dissolved in about 250 cubic centimeters of hot benzyl alcohol. To the clear solution 12 cubic centimeters of hot alcoholic potassium hydroxide solution (1 cubic centimeter = 0.061994 gram potassium hydroxide) containing a very slight excess of the calculated amount of potassium hydroxide, were added with vigorous shaking. The potassium salt of the hexabromide was thrown down as a white, gelatinous precipitate. About 200 cubic centimeters of absolute alcohol were then added and the mixture heated (reflux) on a water bath for about five hours. The mixture was cooled, the supernatant liquid poured off, and the salt washed well with ether by decantation in order to remove all the benzyl alcohol. If the benzyl alcohol is not entirely removed, the salt is somewhat oily and difficult to dry.

In order to purify the potassium salt, it was washed with hot benzene to dissolve any unchanged hexabromide which might be present. The salt was then washed with ether and dried in a desiccator. Experiments showed that it is not desirable to dry salts of the hexabromide in an oven at 80° C., because continued heating tends to turn them somewhat brown, due to slight decomposition.

A determination of the melting point showed that at 180° C. the salt begins to turn slightly brown and that it melts, with decomposition, to an opaque brown liquid at 185° C. to 190° C.

In preparing the potassium salt, propyl alcohol, isopropyl alcohol, and isobutyl alcohol can be used in place of benzyl alcohol to dissolve the hexabromide. However, the acid is not so soluble in these solvents as in benzyl alcohol, so that about 500 cubic centimeters are required for each 5 grams of the acid and the solution is turbid.

Analysis of potassium salt of linolenic hexabromide.

[0.1569 gram salt gave 0.2200 gram silver bromide.]

	Bromine. Per cent.
Calculated for $C_{18}H_{29}Br_6O_2K$	60.25
Found	59.67

Barium salt of linolenic hexabromide.—Five grams of the potassium salt of linolenic hexabromide were dissolved in about 3 liters of hot methyl alcohol and filtered. The solution was then heated again on a water bath. A solution of barium bromide was prepared by dissolving the salt in about 5 cubic centimeters of water and adding 100 cubic centimeters of methyl alcohol. This solution of barium bromide, containing about 2.3 grams of the salt, was heated and then added with constant shaking to the hot alcoholic solution of the potassium salt. A white precipitate was formed immediately. The mixture was divided into two portions which were heated (reflux) for about nine hours. The liquid above the precipitate was then perfectly clear, an indication that the reaction was complete. The whole mixture was distilled to a volume of about 500 cubic centimeters, after which it was allowed to cool, and then thrown into about 1.5 liters of water, stirred, and filtered immediately. This treatment with water removed the potassium bromide and also the excess barium bromide, as shown by the bromide test with silver nitrate. The residue was washed with methyl alcohol and ether. It was then dried on layers of filter paper, powdered, and placed in a desiccator.

A melting point determination showed that, without crystallization, the barium salt of linolenic hexabromide turned slightly brown at 197° C., and became a brownish black mass at 200° C. without melting completely.

The formula of the salt was checked by determining the percentage of barium. A weighed quantity of the salt, placed in a porcelain crucible, was treated with a few drops of concentrated sulphuric acid and heated gently by heat reflected from a hot asbestos board placed above the crucible. In this way spattering of material was avoided. After ignition with a Bunsen flame the barium was weighed as barium sulphate.

Analysis of barium salt of linolenic hexabromide.

[0.5160 gram of the salt gave 0.0726 gram barium sulphate.]

	Barium. Per cent.
Calculated for $C_{36}H_{58}Br_{12}O_4Ba$	8.32
Found	8.28

Zinc salt of linolenic hexabromide.—The zinc salt of linolenic hexabromide was prepared in the same way as the barium salt by mixing a hot solution of the potassium salt of linolenic hexabromide in methyl alcohol with a hot solution of zinc chloride in methyl alcohol (95 per cent). A white flocculent precipitate was formed. The mixture was then heated (reflux) until the methyl alcohol above the precipitate was completely clear, after which it was distilled to about one-sixth its volume and then allowed to cool. The precipitate was thrown into water, stirred, and filtered immediately. It was washed with methyl alcohol and ether, and then dried.

A melting point determination showed that, without crystallization, the salt decomposed sharply at 174° C.

The formula of the salt was checked by analysis in the same manner as was the formula of the barium salt. A weighed quantity of the salt was converted into zinc sulphate by treating it with sulphuric acid. The zinc sulphate was then heated and weighed as zinc oxide.

Analysis of zinc salt of linolenic hexabromide.

[0.6139 gram of the salt gave 0.0292 gram zinc oxide.]

	Zinc. Per cent.
Calculated for $C_{36}H_{58}Br_{12}O_4Zn$	4.14
Found	3.82

Lead salt of linolenic hexabromide.—Five grams of linolenic hexabromide were dissolved in about 500 cubic centimeters of boiling ethyl acetate. To the clear acid solution there was added with constant shaking a boiling, turbid, alcoholic solution of normal lead acetate, containing a slight excess of the calculated amount of the salt. A white flocculent precipitate was formed. The mixture was heated (reflux) until the solution above the precipitate was completely clear. It was then distilled to about one-third the volume, thrown into water, and the mixture stirred and filtered. The residue was washed thoroughly with alcohol and ether, and then dried.

When the melting point was determined the salt turned slightly brown at 160° C., and melted, with decomposition, at 190° C. to 195° C.

Analysis of lead salt of linolenic hexabromide.

[0.2536 gram of salt gave 0.0452 gram lead sulphate]

	Lead. Per cent.
Calculated for $C_{36}H_{58}Br_{12}O_4Pb$	12.04
Found	12.18

Solubility.—Qualitative solubility experiments on the free linolenic hexabromide and the salts that we prepared were made at room temperature (about 30° C. and designated as cold), and also in hot solvents. For low-boiling solvents like acetone, the solubility in hot solution was determined at the boiling temperature of the solvent. With high-boiling solvents, such as xylene, the temperature for solubility determination was about 90° C. In reporting the qualitative solubility data, the term "soluble" is used for solvents which dissolve the acid or the salts to the extent of about 1 to 4 per cent. For solubility below 1 per cent the terms "insoluble" or "slightly soluble" are used. The term "very soluble" is used when about 5 per cent or more of the acid or the salts is dissolved.

TABLE 1.—*Solubility of linolenic hexabromide and some of its salts in different solvents.*

[I=insoluble; ss=slightly soluble; S=soluble; VS=very soluble.]

Solvent.	Hexabromide.		Potassium salt.		Barium salt.		Zinc salt.		Lead salt.	
	Cold.	Hot.	Cold.	Hot.	Cold.	Hot.	Cold.	Hot.	Cold.	Hot.
Acetic acid, glacial	ss	S	ss	S	ss	S	ss	S	ss	VS
Acetone	I	ss	I	ss	ss	ss	ss	ss	I	I
Amyl alcohol	ss	VS	I	ss	I	I	I	I	I	I
Amyl nitrate	ss	S	I	I	I	ss	I	I	I	I
Benzaldehyde	ss	VS	ss	VS	ss	VS	ss	VS	ss	VS
Benzene	ss	S	I	I	I	I	ss	ss	I	I
Benzyl alcohol	ss	VS	I	ss	I	S	I	S	I	S
Chloroform	I	ss	I	I	I	I	I	ss	I	I
Carbon tetrachloride	I	ss	I	I	ss	ss	I	ss	I	I
Ether	ss	ss	I	I	I	I	I	ss	I	I
Ethyl alcohol	ss	ss	ss	ss	I	ss	I	ss	ss	ss
Ethyl acetate	ss	S	I	ss	I	ss	I	ss	ss	ss
Ethyl benzoate	ss	VS	I	ss	I	I	I	ss	I	ss
Ethyl bromide	ss	ss	I	I	ss	ss	ss	ss	ss	ss
Ethylene bromide	ss	VS	ss	ss	ss	ss	ss	ss	ss	ss
Isopropyl alcohol	ss	ss	ss	ss	I	I	I	I	I	I
Isobutyl alcohol	ss	S	ss	ss	ss	ss	ss	ss	ss	ss
Ligroin	I	I	I	I	I	I	I	I	I	I
Methyl alcohol	ss	ss	ss	ss	ss	ss	ss	ss	ss	ss
Methyl salicylate	ss	VS	I	ss	I	I	I	ss	ss	ss
Nitro benzene	I	VS	I	I	I	I	I	S	I	S
Propyl alcohol (*n*)	ss	S	ss	S	ss	ss	ss	ss	I	ss
Petroleum ether	I	I	I	I	I	I	I	I	I	I
Pyridine	VS	VS	I	I	I	ss	ss	VS	ss	ss
Toluene	ss	S	I	I	I	I	I	I	I	I
Terpinol	ss	VS	I	I	I	ss	I	ss	I	ss
Xylene	ss	VS	I	I	I	I	I	I	I	I
Water	I	I	I	I	I	I	I	I	I	I

As shown by the solubility data given in Table 1, linolenic hexabromide and the salts prepared from it are not very soluble in the ordinary organic solvents. Experiments showed that about 10 grams of the acid will dissolve in 200 cubic centimeters of benzyl alcohol at 100° C. Five grams of the acid will dissolve in 500 cubic centimeters of warm isobutyl alcohol, and 21 grams of acid will dissolve in 400 cubic centimeters of warm xylene.

Although linolenic hexabromide is somewhat soluble in various solvents, salts of the acid are mostly insoluble or only slightly soluble. All of them, however, are soluble in hot benzaldehyde and glacial acetic acid. The barium salt is soluble in hot benzyl alcohol; the zinc salt dissolves in hot benzyl alcohol, nitro benzene, and pyridine; and the lead salt is soluble in hot benzyl alcohol and nitro benzene. Hot normal propyl alcohol dissolves the potassium salt.

Melting point.—A determination of the melting point of the salts. showed that they all decompose when heated to a sufficiently high temperature. This is not surprising since, according to the literature,[9] various salts of long-chain aliphatic acids do not give a sharp melting point.

Several salts of acids such as myristic, palmitic, daturic, and stearic have been prepared by other investigators, but the melting-point data [10] of these salts are not recorded in the usual reference books.

Of the various salts that we prepared the zinc salt seemed to give the best melting point, although it melted sharply with decomposition.

In this connection it may be noted that, of the various salts prepared from linolenic and linolic acids, the zinc salt [11] appears to be the most stable.

SUMMARY

A considerable quantity of linolenic hexabromide (melting point, 179.5° C. to 180.5° C.) was prepared.

The lead salt of linolenic hexabromide was prepared by treating a solution of the free acid with an alcoholic solution of lead acetate.

The potassium salt of linolenic hexabromide was prepared by neutralizing the free acid, dissolved in an organic solvent, with an alcoholic solution of potassium hydroxide.

From the potassium salt of linolenic hexabromide, the barium and zinc salts were prepared.

The solubility of linolenic hexabromide and of the postassium, barium, zinc, and lead salts of this acid was determined for various solvents. The melting point of these compounds was also determined.

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[9] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 156, 157, 160, 163, 172, 175, 191, 192, 200, 204; Beilstein's Handbuch der organischen Chemie, Vierte Auflage, 2 (1920) 361, 369, 372, 395, 396, 473; Caspari, C. E., Am. Chem. Journ. 27 (1902) 307, 310.

[10] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 160, 163, 165, 168, 169, 191; Beilstein's Handbuch der organischen Chemie, Vierte Auflage, 2 (1920) 365, 372, 379, 387, 465, 496.

[11] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats, and Waxes 1 (1921) 213; Reformatzky, A., Journ. für Prak. Chem. 41 (1890) 537.

BRACONIDÆ-CHELONINÆ OF THE PHILIPPINES, MALAYA, AND AUSTRALIA [1]

I. CHELONINI (EXCEPT CHELONUS)

By CHARLES FULLER BAKER
Of Los Baños, Philippine Islands

Field work in Malaya and the Philippines, extending through fourteen years, shows this important group to be highly developed, and abundant everywhere in these regions in both species and individuals. There have been described previously from the entire Orient (southeast Asia, the Malayan, Moluccan, and Papuan Archipelagoes, and Australia) some fifty species in the subfamily Cheloninæ; but it is not difficult to find more than that number in any one good locality in the Philippines—practically all unknown up to this time. Some members of the group play a very large part in the economy of Nature, as for instance in the case of a *Chelonus* described below which may easily be reared by thousands from *Crocidolomia binotalis* at Los Baños.

This group presents an excellent example of the fact that a classification of sorts may be a very ready possibility when but a few specimens of a few species are known, but that often it becomes very difficult with large series of specimens and species. Such series may show at once that some of the characters previously used for separation of species and even genera are highly variable, and cannot be employed for such purposes. Coloration is highly variable and descriptions based only on color characters are usually quite useless. For instance, bred series show that some species, with the abdomen yellow-marked in the female, have entirely black males; also that the extent of black markings in largely ferruginous species is highly variable. At the same time, the range of coloration in the subfamily is not great and many species are practically identical in coloration. Also, in certain structural characters there is often wide variation, as in some of the minuter details of the very coarse sculpturation. For the same reason, certain details of wing venation cannot be used for synoptical purposes. The insertion of the recurrent nervure is highly variable and may vary from interstitial to distinctly entering the first or second cubital cell, in the same species. In the female, antennæ of sixteen joints are rather regularly of this number, but both male and female antennæ of more-numerous joints are usually variable by several joints more or less. The dentation of the apex of the abdomen is a sexual character, as is also the elongation of the palpi. In some genera the antennæ in the female (especially when sixteen-jointed) are shorter and more terete than in the male, but in other cases are very similar to those of the male. Thus, the characters given for *Arichelonus* Viereck, *Microchelonus* Szepl., *Chelonella* Szepl., *Bitomus* Szepl., and *Neophanerotoma* Szepl. are either merely sexual characters of scarcely group value, or characters that vary widely in every possible combination among closely related species. In a large series of species of tropical oriental *Phanerotoma*, the characters given by Szepligeti for *Neophanerotoma* have no generic value, occurring in every possible gradation and combination.

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[1] Of this series covering certain groups of the ichneumonoid parasites, the paper on the Rhogadinæ (except *Rhogas*), was published in Philip. Journ. Sci. § D 12 (1917) 281–327. The second paper, on the genus *Rhogas*, was published in Philip. Journ. Sci. § D 12 (1917) 383–422.

Gastrotheca Guerin has a cyclostomatous mouth and must be referred to the cyclostomine series as noted by Brues.[2] The true position of *Trachypetus* Guerin, described from Australia as having a petiolate abdomen, is also problematical.

An attempt is made herein to arrange the material now in hand. Certain very strongly divergent types which do not appear to be referable to any older genera are here separated as distinct genera, the ensemble of characters of diagnostic value being entirely distinctive; but extensive new material from New Guinea, Central Africa, or some other unexplored region may submerge these, just as the present extensive material renders *Neophanerotoma* and certain others quite meaningless.

In the following descriptions an attempt is made to consider only characters of diagnostic value, and to avoid unnecessary detailing of characters common to the subfamily, the tribe, or the genus. Thus the palpi are generally, throughout the subfamily, stramineous or yellowish in color and exceptions are very rare, there being only two among the species mentioned in this paper; namely, *Ascogaster palpalis* Szepligeti and *A. intensus* sp. nov. Also, as a general rule, the second transverse cubital nervure is decolored and commonly suffused with whitish; in only four of the species herein is it fully colored: namely, *Megachelonus uniformis* sp. nov., *M. bicoloricornis* sp. nov., *Ascogaster inconspicuus* sp. nov., and *A. luzonensis* sp. nov. In the vast majority of species the hind coxæ are smooth, with sparse minute punctures; only in the genus *Cascogaster* are they more heavily sculptured. All species are clothed with more or less of usually whitish pubescence; ordinarily this is denser on face, pleuræ, apex of abdomen, and tibiæ and tarsi; usually it does not offer any very clear diagnostic distinctions, though it does so rarely, as in *Megachelonus*.

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[2] Ann. S. Afr. Mus. 19 (1924) 76.

Synopsis of tribes of Cheloninæ.

a^1. Abdominal sutures obsolete, the tergum a solid carapace........ **Chelonini.**

a^2. Abdomen usually with two distinct sutures (the second said to be obsolete in *Bitomus*); first abscissa of cubitus always present.

  b^1. Abdomen shorter than head and thorax together, not strongly elongately narrowed basally, but subelliptical in outline, the third segment not broader than the quadrate second; second cubital cell never elongate rectangular, usually subtriangular; head subcubical .... **Phanerotomini.**

  b^2. Abdomen longer than head and thorax together, strongly narrowed basally, clavate in outline, the third segment greatly enlarged, broader than the long trapezoidal second segment and very broadly rounded and deep apically; second cubital cell usually elongate rectangular; head very strongly transverse.................... **Sigalphini.**[3]

Synopsis of genera of Indo-Malayan-Australian Chelonini.[4]

a^1. First abscissa of cubitus obsolete, first cubital and first discoidal cells therefore confluent; eyes pubescent.

  b^1. Viewed from above the interocular width is but little greater than the width of an eye and the front is distinctly convexly extended beyond eyes; head cubical, genæ broad above and back of the eyes, the antennal scrobes distant from occipital margin; posterior face of propodeum not separated from superior face by a transverse rim; thorax and abdomen strongly elongate, though otherwise of normal *Chelonus* form; the abdomen subparallel-sided and distinctly larger than thorax; first abscissa of radius distinctly short or shorter than second; nervulus very far postfurcal (to ⅓ to ⅖ of first abscissa of discoidal); antennæ (female) 36-, (male) 45-jointed; size medium to large................................ **Cubochelonus g. nov.**

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[3] Includes *Sigalphus* Ill. (= *Sphaeropyx* Ill.). The "*Sigalphus*" of later authors is *Triaspis* Hal. (Triaspinæ).

[4] *Trachypetus* Guerin of Australia is not included in this tribe.

b^2. Viewed from above, the interocular width is always distinctly greater than the width of an eye and the front is little if any extended; head distinctly transverse, genæ strongly narrowed above, the antennal scrobes reaching near to occipital margin; posterior face of propodeum always separated from superior face by a transverse rim.

c^1. Head large, markedly transversely subquadrate because of very prominent eyes, and much broader than thorax; the vertex usually distinctly concave between eyes; inner orbits usually rapidly diverging apicad; stigma very large and broad; first abscissa of radius as long as or longer than second; nervulus shortly postfurcal (to ⅙ first abscissa of discoidal); male carapace with apical aperture and more or less acute apically; female usually with apical teeth, the ventral cavity being extended to apex; middle of tergum also distinctly costulate; antennæ (female) 13-jointed.. **Megachelonus** g. nov.

c^2. Head normal (for *Chelonus*); eyes not at all prominent; inner orbits subparallel; stigma normal; antennæ (female) 16-jointed (in Malayan species)... **Chelonus** Jurine.

a^2. First abscissa of cubitus present; eyes naked.

b^1. First transverse cubital straight or nearly so; first abscissa of radius usually as long as or longer than second abscissa; nervulus far postfurcal; stigma short and deep; prestigma strongly developed; subdiscoidal nervure arising near apex of discoidal.

c^1. Median ocellus far in advance of lateral; head always sculptured very differently from mesonotum; mesonotum rather broadly rounded apically; neither lateral nor apical borders of scrobes with largely developed denticles; none of present species with acutely pointed abdomen, the ventral cavity in all cases broadly reaching apex; transverse rim of propodeum without large teeth, such teeth small or wanting; cubitus arising from prestigma; abdomen always shorter than head and thorax together (as to Malayan species)................................... **Ascogaster** Wesmael.

c^2. Median ocellus vertical and standing partly within line of lateral ocelli; head grossly areolate, like mesonotum; mesonotum somewhat longer and distinctly narrowed apicad, not broadly rounded; lateral or apical borders of scrobes with largely developed denticles; abdomen acutely pointed, the ventral concavity falling far short of reaching apex; raised transverse rim of propodeum with strongly extended teeth of great size; cubitus issuing from basal vein far from prestigma; abdomen as long as head and thorax together; propodeum grossly quadridentate.
Cascogaster g. nov.

b^2. First transverse cubital strongly arched toward stigma; first abscissa of radius distinctly shorter than second; nervulus very shortly postfurcal; stigma long lanceolate; prestigma subobsolete but cubitus arising here; subdiscoidal nervure arising far above apex of discoidal; very large, slenderly elongate species, with extended, teatlike apex of carapace; in both male and female, abdomen longer than head and thorax together; propodeum unarmed.
Megascogaster g. nov.

Genus CUBOCHELONUS novum

This segregate differs from *Chelonus* as stated in the synopsis above. The cubical head and strongly elongate form at once distinguish it. Of Cheloninæ with eyes not at all prominent, none have the genæ above and the occipital region so strongly developed; the distance from superior orbit to occipital margin about equals the width of eye. Although not at all prominent, the eyes are large and distinctly long elliptical; malar space not half length of eye. Maxillary palpi 5-jointed, last four joints long and slender, progressively slenderer, subequal in length, reaching to fore coxæ. Labial palpi 4-jointed, second joint strongly swollen, roundly extended apically beyond insertion of third which is a little swollen apically and one-half length of fourth. The posterior face of propodeum is not separated from the superior surface by a transverse carinate ridge, and the surface is evenly sloping from metanotum to insertion of abdomen; abdomen broadly rounded as in *Chelonus*, the ventral cavity not reaching apex. The straight sides of abdomen are characteristic of both sexes. Prosternum very long, nearly twice the length of fore coxæ, uniformly coarsely foveolate, medially fine sulcate.

Type, *Cubochelonus luzonicus* sp. nov.

In fourteen years of collecting no representatives of this genus have been encountered elsewhere than on Mount Maquiling, central Luzon.

Synopsis of species of Cubochelonus g. nov.

a^1. Prestigma yellowish; wing conspicuously white-banded at middle; abdomen broadly yellow-banded on basal half.......... **C. luzonicus** sp. nov.
a^2. Prestigma black, wing hyaline basally but not white fasciate at middle; abdomen black above.......... **C. tagalicus** sp. nov.

Cubochelonus luzonicus sp. nov.

Length, female, 6.5 millimeters; male, 5.

Female.—Black; abdomen on basal half with a broad yellowish transverse band, this band straight-edged posteriorly, anteriorly irregular and not reaching base; antennæ with scape, annellus, and base of third joint ferruginous, remainder piceous. Mandibles ferruginous. Wings deeply infumated apically, stigma and veins dark, prestigma yellowish, a white transverse fascia extending across the wing from prestigma; in this band the recurrent nervure and second abscissa of discoidal are white; extreme base of median vein and second transverse cubital decolored. The male differs in having the abdominal band somewhat obscured, more of the flagellum basally ferruginous, the fore legs entirely ferruginous, the middle legs with ferruginous tarsi, tibiæ, and apices of femora, and the hind legs with ferruginous tarsi and a pale annulus near base of tibiæ. Short silvery pile thicker on legs and thorax. General color of wing paler, veins paler.

Clypeus in female rather strongly and closely punctate, anterior margin medially short toothed. Face coarsely rugose-punctate, above with a short broad sulcus between bases of antennæ; scrobes rather deeply excavated, smooth, shining, and remotely large punctate within, no median carina, carinately rimmed only below. Genæ obliquely coarsely rugose-punctate. Vertex with irregular crowded punctures and pits of very variable size, the rugæ separating them smooth and shining. Mesonotum medially on basal half with very large crowded foveolæ, those at extreme base longitudinally arranged, and with a line of such foveolæ marking the course of notauli; lateral areas and the anterior half shining and with separated coarse punctures. Scutellum with small separated punctures medially, anteriorly septemfoveate. Propodeum entirely, very coarsely, deeply, and uniformly foveolate, including the posterior face—as are also the mesopleuræ. Carapace with the humeral angles sharply prominent and the humeral ridges extending straight caudad, between them some six equally strong costulæ; on posterior two-thirds of tergum the sculpturation becomes a rather fine rugulose foveolation without longitudinal trend, the foveolæ having crowded secondary pits. Antennæ reaching to middle of tergum, 45-jointed, strongly tapering apically; annellus very short, about one-fourth length of first flagellar joint, the latter not as long as and about half width of scape. The male differs in having the rugosities of face distinctly transverse and the short superior median sulcus absent. Antennæ of same form as in female but 36- to 37-jointed. Rugæ of posterior two-thirds of tergum distinctly longitudinal, ventral cavity reaching much nearer apex than in female. First abscissa of radius distinctly shorter than second, and hardly as long as transverse cubitus. Nervulus postfurcal to one-third of first abscissa of discoidal.

Mount Maquiling, central Luzon (*Baker*).

Cubochelonus tagalicus sp. nov.

Length, female, 6 to 7 millimeters; male, 4.5.

Female.—Black; venter yellowish and this showing through very slightly at sides near base of tergum; antennæ with scape and annellus ferruginous, flagellum piceous; mandibles ferruginous, tips black. Fore legs with tarsi, tibiæ, and apices of femora ferruginous, remainder of femora and coxæ piceous, middle and hind legs except hind coxæ, piceous. Wings moderately infumated on apical half, hyaline from level of stigma to base; stigma and adjoining veins dark, median, discoidal, and recurrent nervures paler; prestigma and basal vein very dark; extreme base of median vein and second transverse cubital decolored. The male differs only in having the middle legs like the fore legs, the femora and coxæ of both being also ferruginous.

Structurally differing from *C. luzonicus* as follows: Clypeus with punctures very variable in size, some of the anterior coalescing into irregular pits; face also with two distinct, short, longitudinal, shallow, submedian depressions which divide the face at middle into thirds; antennæ not so strongly tapering as in *C. luzonicus* and somewhat longer. The male has the clypeus much less strongly punctured, with no punctures coalescing; tergum with basal costulæ fewer and the foveolations between them much larger and deeper. First abscissa of radius distinctly shorter than the rather short second abscissa, the latter subequal to the second transverse cubitus. Nervulus as in *C. luzonicus*.

Mount Maquiling, central Luzon (*Baker*).

Genus MEGACHELONUS novum

Viewed from above, the distance between the prominent eyes is much greater than the width of an eye, and the anterior transverse border of face (as seen from above) is nearly straight, the front not at all extended; the face is correspondingly broad, much broader than long; in lateral view the eye is distinctly long elliptical or ovoid, the malar space not as long as an eye is broad, and not greater than half its length. Maxillary palpi similar to those of *Cubochelonus* but, due to the far shorter prosternum, reaching to hind border of fore coxæ. Labial palpi with third joint inserted at apex of the somewhat swollen second. Abdomen not longer than thorax, general form normally chelonoid in female, somewhat spindle-shaped and more or less acute apically in male. Posterior face of propodeum abruptly declivous, concave, separated from upper face by a prominent carinate rim, which is laterally and submedially more or less strongly toothed. Prosternum small, scarcely one and a half times length of fore coxæ, median sulcus broad and deep, flanked by very large foveolæ.

The sexual characters of this group are very marked; the males have a variously shaped apical aperture in the carapace; in the females the ventral concavity usually reaches the apex and there has its bounding apical angles toothed; rarely the ventral cavity does not reach apex and is normally chelonoid.

In all of the species, the thorax has a rather pronounced grayish cast, due to the rather thick coarse appressed pile.

Type, *Megachelonus bidentatus* sp. nov.

Synopsis of species of Megachelonus g. nov.

FEMALES

a^1. Abdomen very deep apically and here broadly rounded, not bidentate at apex, the ventral cavity far from reaching apex; midtergal foveolæ small, simply pentangular or sexangular, their rims fine and uniform, forming no connected and distinctly longitudinal costulæ in the middle third; prestigma stramineous; radial cell infuscate; length, 5 millimeters.......... **M. areolellus** sp. nov.

a^2. Abdomen of equal depth throughout as seen from side, the ventral cavity reaching apex and there with its terminal lateral angles strongly porrectly dentate; midtergal foveolæ lying between distinctly longitudinal costulæ; wings hyaline.

  b^1. Carapace broadly yellow at base; large, stout species; length, 5.75 millimeters.......... **M. bidentatus** sp. nov.

  b^2. Carapace black throughout.

    c^1. Antennæ 16-jointed; small species, length, 3.5 millimeters; apical opening of ventral cavity distinctly ventral, the apex of carapace roundly out-swollen above it.

      d^1. Antennæ with uniformly dark ferruginous flagellum; hind femora entirely pale ferruginous; length, 3.5 millimeters. **M. uniformis** sp. nov.

      d^2. Antennæ with basal half of flagellum pale ferruginous, apical half piceous in strong contrast; hind femora piceous at apices; length, 4 millimeters.......... **M. bicoloricornis** sp. nov.

    c^2. Antennæ more than 19-jointed, large species, length, 5.5 millimeters; apical opening of ventral cavity extended upward and occupying whole apex of the narrowly extended extremity of carapace, and before it dorsally a strong transverse impression. **M. rectangularis** sp. nov.

MALES

a^1. Prestigma stramineous; genital aperture semicircular.
  b^1. Abdomen basally broadly yellow; radial cell infuscate; length, 5.5 millimeters .... **M. bidentatus sp. nov.**
  b^2. Abdomen black; radial cell hyaline; length, 6 millimeters. **M. megacephalus sp. nov.**
a^2. Prestigma piceous; genital aperture circular; abdomen black; length, 4 to 4.25 millimeters .... **M. consociatus sp. nov.**

Megachelonus areolellus sp. nov.

Length, female, 5 millimeters.

Female.—Black; abdomen with entire basal third yellowish; scape, annellus, and most of first flagellar joint yellowish; remainder of flagellum dark ferruginous. Mandibles yellowish. Hind legs piceous, apices of coxæ, trochanters, extreme bases of femora, and tarsi dark yellowish; middle and fore legs dark yellowish throughout. Wings hyaline with region of radial cell somewhat infumated; prestigma, costa, and basal and median veins yellowish, remaining veins dark but none so dark as stigma; tegulæ yellowish.

Clypeus closely, finely punctured basally, apically more coarsely and sparsely, the middle third of anterior margin slightly, roundly extended. Face finely, densely, uniformly rugosopunctate, with a very short, smooth median carina at base. Scrobes sharp-margined below and between antennæ, divided medially by an obtuse longitudinal ridge, the basins longitudinally wrinkled at extreme sides, within and above minutely, shallowly foveolate, and rather strongly narrowed above. Genæ densely, obliquely wrinkled. Vertex transversely wrinkled, becoming foveolate in the ocellocular area. Posterior ocelli widely separated, the distance between their outer margins being equal to the ocellocular distance. Notauli extending to base, marked by a row of large foveolæ larger at base, between these with two longitudinal rows of large foveolæ on either side of a rough but strong median carina which with its flanking foveolæ is percurrent. Lateral basal areas of mesonotum punctate, submedian anterior areas weakly transversely rugose. Scutellum basally sexfoveate, centrally smooth and shining, minutely but very sparsely punctate. Propodeum with a very strongly marked deeply sexfoveate median subtriangular area, its apical margin deeply depressed and emarginate, its lateral apical angles projecting over posterior face as two very stout protuberant teeth; posterior lateral angles of propodeum numerous than in female, and more teretely filamentous. First and second abscissæ of radius subequal, the second transverse cubital a little shorter. Nervulus postfurcal to one-fourth of the first abscissa of discoidal.

Singapore (*Baker*).

Megachelonus megacephalus sp. nov.

Length, male, 6 millimeters.

Male.—Black, without yellow on abdomen, either above or below. Antennæ basally very dark ferruginous, becoming piceous apically. Mandibles very dark ferruginous; legs pale ferruginous; apical two-thirds of hind femora and all hind tarsi piceous. Wings hyaline; prestigma, costa, and basal and median veins pale yellowish; remaining veins progressively darker but none so dark as stigma. Tegulæ ferruginous.

Clypeus smooth and shining, very sparsely punctate, the anterior margin broadly arcuate. Face with median carina indistinct apically, basally strongly, sharply raised, and percurrent between scrobes; surface of face transversely (at sides obliquely) coarsely, shallowly, irregularly rugose. Scrobes sharp-margined at sides and below, smooth and shining within, several longitudinal rugæ between scrobes and orbits. Genæ with several strong irregular rugæ near eye, remainder of surface very indistinctly rugose. Vertex not concave, coarsely, shallowly, confusedly rugose with some small punctures; total width of ocellar area about equal to ocellocular width. Sculpturation of thorax and abdomen very similar to that of *M. bidentatus;* triangular area of propodeum deeply depressed and very broad apically. Form of abdomen very similar to that of *M. bidentatus* except that, as viewed from side, there is a slight extension of the apex below the aperture. Apical aperture as in *M. bidentatus*. First abscissa of radius distinctly longer than second, the latter a little longer than second transverse cubital. Nervulus postfurcal to one-fourth first abscissa of discoidal.

Surigao, northeastern Mindanao (*Baker*).

This is the largest species of the genus.

Megachelonus consociatus sp. nov.

Length, male, 4 to 4.25 millimeters.

Black, without yellow on abdomen, either above or below. Antennæ with scape, annellus, and flagellum basally beneath pale ferruginous, remainder very dark ferruginous. Legs pale ferruginous, apical halves of hind tibiæ, and hind tarsi piceous. Wings hyaline, the median veins stramineous, remainder, including basal, dark, the stigma and prestigma very dark. Tegulæ ferruginous.

Clypeus rather closely, coarsely punctured, anterior margin broadly arcuate; face with large, deep foveolæ separated by high sharp rugæ, larger and more irregular near clypeus; the upper showing a tendency to transverse arrangement; no indication of median carina. Scrobes separated by a high and strong carina, highest between antennæ, the entire inner surface of scrobes coarsely foveolate; one high, strong, longitudinal ruga between scrobes and orbit. Vertex with very strong pentangular and sexangular foveolæ, the entire width of ocellar area subequal to the ocellocular width. Genæ entirely very coarsely foveolated, the foveolæ near eye longitudinally arranged. Entire mesonotum coarsely foveolate, those on median basal area very strong and deep and arranged in four longitudinal rows, those elsewhere shallower and more irregular. Scutellum basally quinquefoveate, the middle area occupied by about six large foveæ. Propodeum very short at middle, the median area high-rimmed, deeply depressed, very broad apically and within with but two transverse rows of very large foveæ, two basal and five apical; except for the broad, deep emargination of the medium area, the hind margin of upper and lateral faces broadly, laminately expanded caudad and with laminate teeth bounding median area and at lateral angles; the deeply excavated posterior face thickly covered with subcircular foveolæ. Abdomen narrowly subelliptical in outline, gradually narrowed to a subacute apex, this appearance produced by a slight extension below the apical aperture; viewed from the side the abdomen is somewhat deeper apically than basally. Ventral cavity falling far short of reaching apex. Apical aperture subcircular. Antennæ 25-jointed, the flagellum evenly, teretely filamentous, acute at tips. First abscissa of radius distinctly longer than second and the latter subequal to second transverse cubital. Nervulus shortly postfurcal.

Singapore (*Baker*).

During the days when this species was taken, males were common on the wing, but not a female was seen. A great excess of males is a rare occurrence in this subfamily.

pale ferruginous, remainder very dark ferruginous. Legs pale ferruginous, apical halves of hind tibiæ, and hind tarsi piceous. Wings hyaline, the median veins stramineous, remainder, including basal, dark, the stigma and prestigma very dark. Tegulæ ferruginous.

Clypeus rather closely, coarsely punctured, anterior margin broadly arcuate; face with large, deep foveolæ separated by high sharp rugæ, larger and more irregular near clypeus; the upper showing a tendency to transverse arrangement; no indication of median carina. Scrobes separated by a high and strong carina, highest between antennæ, the entire inner surface of scrobes coarsely foveolate; one high, strong, longitudinal ruga between scrobes and orbit. Vertex with very strong pentangular and sexangular foveolæ, the entire width of ocellar area subequal to the ocellocular width. Genæ entirely very coarsely foveolated, the foveolæ near eye longitudinally arranged. Entire mesonotum coarsely foveolate, those on median basal area very strong and deep and arranged in four longitudinal rows, those elsewhere shallower and more irregular. Scutellum basally quinquefoveate, the middle area occupied by about six large foveæ. Propodeum very short at middle, the median area high-rimmed, deeply depressed, very broad apically and within with but two transverse rows of very large foveæ, two basal and five apical; except for the broad, deep emargination of the medium area, the hind margin of upper and lateral faces broadly, laminately expanded caudad and with laminate teeth bounding median area and at lateral angles; the deeply excavated posterior face thickly covered with subcircular foveolæ. Abdomen narrowly subelliptical in outline, gradually narrowed to a subacute apex, this appearance produced by a slight extension below the apical aperture; viewed from the side the abdomen is somewhat deeper apically than basally. Ventral cavity falling far short of reaching apex. Apical aperture subcircular. Antennæ 25-jointed, the flagellum evenly, teretely filamentous, acute at tips. First abscissa of radius distinctly longer than second and the latter subequal to second transverse cubital. Nervulus shortly postfurcal.

Singapore (*Baker*).

During the days when this species was taken, males were common on the wing, but not a female was seen. A great excess of males is a rare occurrence in this subfamily.

Megachelonus uniformis sp. nov.

Length, female, 3.5 millimeters.

Female.—Black, abdomen without yellow; scape and annellus pale ferruginous, flagellum very dark ferruginous. Legs yellowish, hind tarsi piceous. Wing hyaline, veins pale stramineous, the costa, prestigma, stigma, and radial vein clear brown. Tegulæ stramineous.

Clypeus with separated coarse punctures, the anterior margin broadly arcuate. Face coarsely, irregularly, deeply foveolate throughout but with a distinct percurrent median carina, this carina continued to separate the scrobes, very high below and between antennæ, low above. Scrobes smooth and shining within, some irregular foveolæ next median carina, sharp-rimmed below and with one high, sharp, longitudinal ruga between scrobe and orbit. Genæ obliquely rugose punctate. Vertex a little concave, very short, the occipital slope beginning just behind lateral ocelli, small foveolate throughout, over-all ocellar width subequal to ocellocular distance. Thoracic sculpturation as in *M. bidentatus,* except that scutellum is centrally irregularly foveolate; lateral teeth of propodeum far larger and more strongly protuberant than the submedian. Tergum with humeral carinæ hardly distinguishable except at extreme base, the surface with numerous longitudinal percurrent (on basal half) costulæ, the foveolæ between them having a tendency to be quadrangular on basal half, apically the costulæ and much smaller foveolæ are very irregular. Abdomen, viewed from side, of uniform depth throughout, ventral concavity narrowly continued to apex where its bounding angles are protuberantly, porrectly toothed. Antennæ 16-jointed, apical third distinctly flattened and broadened. Nervulus very shortly postfurcal; first abscissa of radius distinctly longer than second abscissa or second transverse cubitus, the latter two subequal, the last not decolored.

Los Baños, Luzon (*Baker*).

This is the smallest species of the genus. A fully colored, second transverse cubital nervure is very unusual in this subfamily.

Megachelonus bicoloricornis sp. nov.

Length, female, 4 millimeters.

Female.—Black, abdomen without yellow markings. Scape and basal half of flagellum pale ferruginous, apical half piceous. Legs pale ferruginous; hind coxæ except apices and apical third of hind tibiæ piceous. Wings hyaline, costa and basal and median veins very pale, remaining veins and stigma much darker. Tegulæ stramineous.

Clypeus with coarse, separated punctures and with a few short, oblique rugæ at extreme sides. Face coarsely foveolate and with many punctures, the foveolæ large, shallow anteriorly, much deeper on upper half of face where the high strong separating rugæ become markedly transverse; rugæ also form an irregular but strong median carina. Scrobes separated by a low median carina and very broadly extended to the high sharp ruga near orbits (this ruga reaching lateral ocellus), the inner surface smooth and shining, largely occupied by separated, rounded foveæ of varying sizes. Genæ and vertex coarsely foveolate. Mesonotum strongly grayish because of appressed pubescence which obscures the sculpturation. Notauli deeply foveolate to half length of mesonotum, the foveolæ being coalescent; between bases of notauli with two short longitudinal rows of large, partially coalescent foveolæ; anterior median area thickly punctate and with two distinct, shallow, longitudinal depressions, a small latero-basal area punctate, remainder shallowly small foveolate. Scutellum quinquefoveolate at base, the three median basal foveæ extended as deep, sharp-rimmed channels, posteriorly across median area. Propodeum very coarsely foveate, the median area deeply depressed and very broad apically, its posterolateral angles and lateral angles of propodeum dentately produced. Mesopleuræ entirely occupied by very large and deep, mostly regularly sexangular foveæ. Abdomen about as long as head and thorax together. Dorsum with humeral carinæ not distinguishable from the many, very strong, straight costulæ, their rims thick and occasionally punctate, and extending to two-thirds length of carapace. Ventral cavity, by a narrow channel, open to apex, there flanked by two short porrect teeth. Antennæ 16-jointed, the flagellum distinctly flattened and broadened on apical half. First abscissa of radius subequal to second, the second transverse cubital distinctly shorter and not decolored. Nervulus very shortly postfurcal.

Tangkulan, Bukidnon Province, Mindanao (*Baker*).

Megachelonus rectangularis sp. nov.

Length, female, 5.5 millimeters.

Female.—Black; abdomen without yellow markings. Scape and annellus pale ferruginous, flagellum piceous. Legs pale ferruginous, anterior paler, hind coxæ and tibiæ somewhat darker, hind tarsi piceous. Wings hyaline, all veins very pale except costa, radius, and second abscissa of cubitus which are pale brown like the stigma. Tegulæ pale ferruginous.

Clypeus rather thickly coarsely punctate, somewhat rugose at extreme sides, and with anterior margin rather narrowly rounded. Face coarsely, deeply, transversely (at the sides obliquely) rugose and medially foveolate, without a median carina. Scrobes separated by a low median carina, the inner surface smooth and shining, obscurely tranversely wrinkled; between scrobes and orbits, three strong rugæ. Genæ obliquely rugose-punctate, punctures thicker near orbit. Vertex somewhat longitudinally rugose-foveolate. Notauli marked by large deep foveolæ; whole mesonotum elsewhere with smaller irregular foveolæ of varying sizes. Scutellum basally with six large somewhat irregular foveæ, the median area bordered all around by deep foveolæ, the disk coarsely punctured and very small foveolate. Propodeum very coarsely, deeply foveolate, the median area of the narrower type, sexfoveolate, not very wide or deeply depressed apically; apical angles very obtusely dentate, as are also lateral angles of propodeum. Pleuræ entirely coarsely foveolate. Dorsum of carapace with numerous costulæ at base, but these soon broken up, forming a great number of elongate, compound foveolæ; the depression before the distinctly extended apex is longitudinally rugose. The apical opening of ventral cavity is carried well on to the dorsal surface of the extended apex where it is preceded by a strong transverse impression; the ovipositor is straightly, correctly exserted from this opening; the sides of the apical opening below, at apices of sides of ventral cavity, are thickly, shortly, dentately extended, but the teeth are thus lateral and not submedial as in other species. Antennæ 19-jointed (broken in the type), the flagellum evidently but very slightly enlarged apically. First abscissa of radius slightly longer than second, the latter distinctly longer than second transverse cubital. Nervulus postfurcal to one-third of first abscissa of discoidal.

Mount Banahao, Laguna Province, Luzon (*Baker*).

This species presents an extreme development of the genital opening that is not duplicated in any other chelonid known to me. It is also very distinct in its other characters.

Genus ASCOGASTER Wesmael

This genus is composed largely of species which closely resemble *Chelonus* of the various groups of that genus, differing most strikingly in the presence of the first abscissa of cubitus; but, in addition, it includes some species of quite distinct structure. It apparently is not a natural group, even as here delimited, and rapidly accumulating material will necessitate a recast of the whole complex at some early date.

The Australian species, so far as known, differ from the Malayan very strikingly, in having the sculpture of head and thorax tending toward simple puncturation instead of foveolation or rugose puncturation. The appendages in the Australian species are also commonly darker than in the Malayan species; but they apparently differ most widely in the antennal scrobes, which usually present simple depressed surfaces sculptured like the vertex, instead of the delimited and differently sculptured cavities of the Malayan species.

Szepligeti[6] described five Australian (New South Wales) and one Papuan species, synopsizing them entirely on color characters, and presenting very incomplete descriptions. I have included these in the following synopsis on such characters as were given, even though it weakens the synopsis to do so. Fullaway[7] described two Javan species; his descriptions are much longer than those of Szepligeti, but are still more difficult to use, since the majority of the characters described are those of the genus, tribe, or subfamily, and therefore the specific position is uncertain.

Synopsis of species of Ascogaster Wesmael.

a^1. Antennal scrobes distinctly delimited by carinate rims, the interior sculpturation different from the exterior, mesonotum largely, strongly foveolate; vertex usually foveolate like the mesonotum; venation pale. Malayan species.
  b^1. Nervulus shortly postfurcal, first abscissa of radius as long as or very little longer than second; usually very small species of short, compact form.
    c^1. Abdomen with more or less yellow at base; a small smoky cloud below the dark stigma.
      d^1. Yellow of tergum bright and clear, occupying a large part of basal third; clypeus coarsely punctate throughout; male, length, 2.75 millimeters............ A. inconspicuus sp. nov.
      d^2. Yellow of tergum an obscure transverse mark at extreme base, clypeus with large median basal area impunctate; male, length, 2.75 millimeters............ A. luzonensis sp. nov.
    c^2. Abdomen black (male); notauli marked by broad lines of foveæ; male, length, 5 millimeters............ A. argentea Fullaway.[8]

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[6] Ann. Mus. Nat. Hung. 3 (1905) 36.

[7] Journ. Straits Asiat. Soc. 80 (1919) 49.

[8] Position doubtful.

b^2. Nervulus long postfurcal; first abscissa of radius considerably longer than second; head seen from above with genæ very broad behind eyes.

c^1. Stigma pale, no smoky cloud beneath it, veins all pale; sculpturation of head and thorax predominantly foveolation and rugose puncturation; male, length, 4 millimeters...... **A. longulus** sp. nov.

c^2. Stigma dark, with a fuscous cloud beneath it; veins dark; sculpturation of head and thorax predominantly coarse simple puncturation; male, length, 4 to 4.5 millimeters; female, 5 millimeters. **A. philippinensis** sp. nov.

a^2. Antennal scrobes not delimited by carinate rims, interior sculpturation, at least above, same as that of adjoining surface; mesonotum largely punctate; venation usually very dark. Australian and Papuan species.

b^1. Head black.

c^1. Hind femora ferruginous.

d^1. Head transverse, strongly narrowing behind eyes as seen from above.

e^1. Small species, length, 3.25 to 3.5 millimeters.

f^1. Notauli wanting; mesonotum, mesopleuræ, and dorsum rugose; clypeus (male) nearly straight-edged anteriorly and with a median tooth; male, length, 3.25 millimeters. **A. australiensis** Szepligeti.

f^2. Notauli distinguishable; mesonotum rugose at middle; mesopleuræ punctured; dorsum "coriaceo-rugose;" clypeus (male) arcuate-edged anteriorly; male, length, 3.5 millimeters.. **A. tegularis** Szepligeti.

e^2. Very large species; female, length, 5 millimeters; abdomen "alutaceous.".. **A. erythropus** Cameron.[9]

d^2. Head subcubical as seen from above, with genal margins long, and throughout (to occiput) as wide as across eyes; tegulæ, scapes, palpi, and abdomen black; male, length, 4.5 millimeters. **A. intensus** sp. nov.

c^2. Hind femora black or piceous; head rugose-punctate or "coriaceous;" clypeus with an evenly arcuate anterior margin.

d^1. Tegulæ and palpi black; head transverse, "coriaceous," the face thickly punctate; antennæ (male) 27-jointed; mesonotum punctate, rugose at middle; mesopleuræ shining on disk; dorsum "coriaceous;" male, length, 4 millimeters. **A. palpalis** Szepligeti.

d^2. Tegulæ and palpi ferruginous to pale yellowish; head rugose-punctate.

e^1. Wings largely hyaline, beneath stigma an indistinct fuscous cloud.

f^1. Dorsum sculptured throughout; male, length, 3.5 millimeters. **A. modestus** sp. nov.

f^2. Dorsum with nearly apical third smooth and shining; female, length, 2.5 millimeters............ **A. laeviventris** sp. nov.

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[9] Position doubtful.

e^1. Wings largely infuscated, usually more deeply so in region of radial cell and beneath stigma.

f^1. Wing with a narrow conspicuous transverse white band crossing from prestigma; length, female, 3 millimeters. **A. cinctus sp. nov.**

f^2. Wing without transverse white band.

g^1. Notauli distinct; abdomen (male) yellow at base; antennæ (male) 26-jointed; mesonotum thickly, finely punctate; mesopleuræ shining; beneath stigma a dark spot; male, length, 2 millimeters........... **A. novoguineensis Szepligeti.**

g^2. Notauli indistinct; abdomen (female) black; antennæ (female) 19-jointed; mesonotum rugose; mesopleuræ punctate; apical margin of dorsum (female) emarginate; ovipositor as long as abdomen and propodeum together; basal vein yellowish; female, length, 4 millimeters.. **A! caudata Szepligeti.**

b^2. Head entirely or largely bright ferruginous.

c^1. Apex of abdomen entirely smooth and shining; basal half of male dorsum yellow.

d^1. Vertex thickly finely punctate; hind tibiæ nearly all black; male, length, 3.5 millimeters................................. **A. tricolor Szepligeti.**

d^2. Vertex transversely rugose, with few weak punctures; hind tibiæ all yellowish; male, length, 2.5 millimeters. **A. detectus sp. nov.**

c^2. Apex of abdomen sculptured throughout.

d^1. Head entirely ferruginous; vertex transverse rugulose-punctate.

e^1. Hind legs largely piceous; wings rather strongly infumated and with a conspicuous, narrow, hyaline transverse band extending from between prestigma and stigma, which does not involve the veins traversed; first abscissa of radius much longer than second transverse cubital nervure; scutellum smooth and shining with very sparse minute punctures; mesonotum basally without median carina; abdomen black; male, length, 3 millimeters........... **A. vividus sp. nov.**

e^2. Hind legs pale yellowish like others; wings less infumated and hyaline crossband inconspicuous; first abscissa of radius subequal to second transverse cubital.

f^1. Scutellum smooth and shining, with very sparse punctures; mesonotum basally without median carina; abdomen with basal third suffused and very dark ferruginous, this very inconspicuous; ? female, length, 3.25 millimeters. **A. vividus sp. nov.**

f^2. Scutellum very coarsely punctured; mesonotum basally with a strong sharp median carina; abdomen with basal third clear stramineous; female, length, 3 millimeters. **A. distinctus sp. nov.**

d^2. Head with the vertex largely black, coarsely punctured, the transverse rugæ very strong; abdomen black; legs yellowish throughout, hind tibiæ whitish basally; male, length, 3.5 millimeters.. **A. maculaticeps sp. nov.**

Ascogaster inconspicuus sp. nov.

Length, male, 2.75 millimeters.

Black; abdomen with a large yellow spot on basal third of dorsum, extending from and including whole width of base, but somewhat roundly narrowed apically. Scapes pale ferruginous; flagella piceous. Legs stramineous, hind coxæ stramineous, darker basally; apical third of hind femora, apical half and extreme base of hind tibiæ, and base of hind tarsi piceous. Wings hyaline, the veins pale brown, costa and stigma darker, basal vein and first abscissa of cubitus paler. Tegulæ dark ferruginous.

Clypeus very coarsely punctate, apically narrowly arcuate. Face very coarsely rugose, the rugosities in large part very strongly oblique—downward and mesad; a strong median carina percurrent to near clypeus, the surface on either side of this basally depressed, more broadly so at extreme base and this area transversely rugose. Lower rims of antennal sockets raised anteriorly into blunt dentate protuberances. Malar space long, about equal to width of eye. Genæ very coarsely longitudinally rugose. Vertex and temples very coarsely, deeply foveolate. Entire mesonotum very strongly deeply foveolate, the foveolæ small on anteromedian area, the notauli not distinguishable. Scutellum very coarsely quadrifoveate at base, median area coarsely rugose. Propodeum covered with very large, deep foveæ, the posterior rim with very strong blunt teeth submedially and laterally. Pleuræ strongly deeply foveolate. Dorsum very coarsely longitudinally foveolate, the larger foveolæ with numerous smaller foveolæ within. Viewed from side the abdomen is about as long as thorax, very gradually deeper apically where it is broadly rounded; ventral cavity reaching nearly to apex. Antennæ 35-jointed and about as long as body, the flagella rather stout, strongly tapering on apical fourth. First abscissa of radius slightly longer than second, the latter about equaling the nondecolored second transverse cubital; nervulus postfurcal to one-fourth length of first abscissa of discoidal. Third abscissa of radius nearly straight.

Cuernos Mountains, Oriental Negros (*Baker*).

Ascogaster luzonensis sp. nov.

At Los Baños, in central Luzon, we found a small species of the same size, same number of antennal joints, and similar type of sculpturation which, however, differs in so many details that it cannot even be considered as a variety of the Negros form (*inconspicuus*).

Male.—Yellow marking of abdomen reduced to an obscure transverse mark at extreme base. Hind coxæ very dark ferruginous at base, hind tibiæ and tarsi except basally pale piceous. Wings with stigma and veins all equally pale brownish, the costa darker, second transverse cubitus not decolored.

Clypeus with large median basal area smooth and shining, impunctate. Facial rugæ much stronger and fewer than in the preceding species. Vertex and mesonotum equally very strongly foveolate. Submedian teeth of posterior rim of propodeum more strongly protuberant. Tergal foveolæ deeper, narrower, more strongly longitudinal and with fewer interior smaller foveolæ. Nervulus very shortly postfurcal.

Ascogaster longulus sp. nov.

Length, male, 4 millimeters.

Black; abdomen with a small irregular median yellow spot near base, the venter more extensively yellowish. Scape pale yellowish, flagellum very dark ferruginous. Legs pale yellowish, the hind tibiæ on apical half and extreme base and the hind tarsi piceous. Mandibles ferruginous, darker at tips. Wings hyaline, stigma and veins pale brownish, second transverse cubital decolored. Tegulæ pale yellowish.

Clypeus roughly, thickly, irregularly punctured, anterior margin medially very broadly rounded. Face very roughly, coarsely, irregularly rugose-foveolate; with a strong but rough, percurrent median carina; parallel to this and to orbits and continued straight apicad from sockets, occur two prominent longitudinal rugæ, not, however, quite as strong as median carina; between these lateral rugæ and the orbits the surface is somewhat concave and weakly but coarsely transversely rugose. Scrobes narrow and sharp-margined, one strong longitudinal ruga between margin and orbit. Genæ thick, set with deep rounded foveolæ, the foveolæ of vertex larger and more angular. Notauli occupied by very large and broad foveæ, between their bases two short longitudinal rows of very large foveæ; remainder of mesonotum covered with smaller rounded foveolæ, those on anterior median area and lateral basal area very small. Scutellum quinquefoveate at base, median area coarsely longitudinally rugose-punctate. Propodeum very coarsely foveolate throughout, the median area strongly broadened apically where its sides are very strongly obtusely dentate, as are also lateral angles of rim. Mesopleuræ thickly, coarsely, rather roundly foveolate. Tergum with the short basal costulæ soon broken up into shallow foveolæ of irregular sizes and shapes and without longitudinal trend. Viewed from side, the abdomen is very gradually deeper to the broadly rounded apex, and not as long as thorax and head together. Antennæ 28-jointed and somewhat longer than entire body, flagella slightly enlarged on apical halves, the tips somewhat attenuate. First abscissa of radius distinctly longer than second, the latter subequal to second transverse cubital. Nervulus shortly postfurcal. Third abscissa of radius distinctly arcuate.

Mount Maquiling, central Luzon (*Baker*).

Ascogaster philippinensis sp. nov.

Length, male, 4 to 4.25 millimeters.

Black; tergum with a clear pale yellowish mark extending from entire breadth of base, long triangularly, to two-fifths the length; remainder of tergum may have a very dark ferruginous cast. Scape pale yellowish below, ferruginous above, flagellum piceous. Legs pale yellowish, fore tibiæ a little darker, pale piceous are middle tibiæ (except basal annulus) and tarsi, darker piceous on upper surface of hind coxæ and femora, and hind tibiæ and tarsi except a white annulus near base of tibiæ. Stigma and veins dark brownish, second transverse cubitus decolored; a narrow infuscation extending from stigma through second cubital cell. Tegulæ dark ferruginous.

Clypeus sparsely coarsely punctate. Face thickly and coarsely but smoothly and deeply punctate, with high, thin median carina on basal half, highest between antennæ and percurrent between scrobes; just above antennal insertions there are several short longitudinal rugæ between rims of scrobes and orbits. Head subcubical, the vertex long extended behind eyes, this extension greater than the over-all ocellar width; surface coarsely, rather closely punctate. Genæ smooth and shining, sparsely, coarsely punctate. Mesonotum without vestige of notauli, a few irregular roundish foveolæ at basal middle, the entire remaining area with very large deep punctures, not very thickly distributed over the shining surface. Scutellum septemfoveate at base, the median surface coarsely punctate and with some smooth indistinct longitudinal rugæ. Propodeum with large, deep, angular foveæ throughout, the median area not demarked, the posterior rim very weak, submedian teeth lacking, lateral teeth short and blunt; posterior face sculptured like superior. Tergum on basal third with numerous weak longitudinal costulæ, on median third with very numerous, elongate, shallow foveæ of irregular form, each with smaller foveolæ within, the larger rims low, thick, and shining; terminal third densely, longitudinally rugose-punctate. Abdomen not quite as long as head and thorax together, viewed from side becoming gradually deeper apically, the apex broadly rounded. Disk of mesopleura covered with round foveolæ of varying sizes. First abscissa of radius considerably longer than second, this subequal to second transverse cubital; third abscissa somewhat arcuate. Nervulus postfurcal to one-third of first abscissa of discoidal. Antennæ 45-jointed, extending beyond abdomen a distance about three-fourths length of abdomen.

Mount Maquiling, central Luzon (*Baker*). Also taken on Mount Banahao.

A larger (length, 5 millimeters), heavier-bodied female from Butuan, Mindanao, must be referred to this species. It has the basal yellow mark of tergum more shortly triangular, and a large round spot on extreme apex of abdomen is somewhat yellowish—though the latter may represent mere aberration. Otherwise the details of structure are very closely similar. The antennæ of this Butuan specimen are unfortunately broken.

This is the only Malayan representative of the Australian group in which the sculpturation is largely coarse punctuation. It, however, possesses the characteristic scrobes and other features of the Malayan species.

Ascogaster intensus sp. nov.

Length, male, 4.5 millimeters.

Black; antennæ black throughout, the scape shining, intense black; palpi black. Mandibles nearly black. All coxæ black, and all tarsi piceous; middle femora and tibiæ and hind tibiæ ferruginous, hind femora strongly reddish. Wings slightly smoky basally, more deeply so apically. Stigma and veins very dark, only the median vein basally paler. Second transverse cubital decolored. Tegulæ black.

Clypeus on median area thickly, coarsely punctate, at sides rugose-punctate, the anterior margin narrowly truncate. Face very short, its breadth about one and a half times the length (antennal sockets to clypeal suture), densely coarse punctate only on a small middle area, otherwise densely rugose-punctate. Scape very short, not reaching median ocellus. Scrobal depression not laterally delimited, and rugose-punctate same as the wide vertex; genæ behind eyes very full and long, as seen from above the head, as wide across base of genæ as across eyes; ocellocular distance much greater than total width of ocellar area. Mesonotum small foveolate on depressed basal area with larger transverse foveæ along lines of notauli, the entire remaining surface thickly, coarsely punctate. Scutellum sexfoveate basally, the entire disk coarsely punctate. Propodeum with superior face very short, irregularly foveate, the moderately deep foveolæ of various sizes and shapes, the median area indistinctly outlined, the posterior rim weak and without submedian or lateral teeth, the posterior face strongly oblique and not deeply concave. Dorsum with short, strong humeral carinæ but without longitudinal costulæ between, the entire surface densely, very evenly, minutely foveolate, without any longitudinal trend, this uniform to the extreme apex; the apex with a short, projecting, thick, vertical, sublamellate keel. Abdomen, viewed from side, as long as head and thorax together, thin basally, deepening rapidly on apical half to the broadly rounded apex. Mesopleura largely covered by small, round, separated foveolæ. First abscissa of radius distinctly longer than second, the latter subequal to second transverse cubitus; third abscissa of radius rather strongly upcurved. Nervulus postfurcal to one-third of first abscissa of discoidal. Antennæ reaching to middle of abdomen, 27-jointed.

Illawarra, New South Wales (*H. Petersen*).

Evidently related to *A. palpalis* Szepligeti, but that species has black hind femora.

Ascogaster modestus sp. nov.

Length, female, 3.5 millimeters.

Black; abdomen with basal third pale yellowish, this angularly extended on median line. Scape, annellus, and first joint of flagellum bright ferruginous, remainder of flagellum piceous. Legs stramineous, hind coxæ and femora black; fore and middle femora, apical third of hind tibiæ, and hind tarsi more or less distinctly piceous. Mandibles ferruginous, palpi stramineous, wings hyaline, a slight fuscous tinge below stigma; stigma and most of veins very dark, basal and median veins testaceous, second transverse cubitus decolored. Tegulæ testaceous.

Clypeus with most of surface shining, coarsely but very sparsely punctate, more densely and rugosely punctate at extreme sides, the anterior margin narrowly subtruncate at middle. Face densely, coarsely punctate, somewhat rugosely so toward malar spaces; straight longitudinal impressions occur submedially. Scrobes coalescent, not specially delimited, and with the interior sculpturation rugose-puncturation like that of vertex. Over-all ocellar width much less than ocellocular distance. Head very short behind eyes, the genæ rapidly narrowed to occiput; length of malar space nearly equal to width of eye; genæ rather sparsely coarse punctate. Mesonotum with large impressed basal area thickly and irregularly, very small foveolate, some foveolæ extending along lines of the scarcely impressed notauli; remainder of surface thickly coarse punctate. Scutellum basally sexfoveate, the disk sparsely coarse punctate. Mesopleura in large part sparsely coarse punctate. Propodeum covered with rounded foveolæ of varying size on upper face, the median area sharply outlined, with about eight foveolæ within, nearly rectangular in outline and not reaching base; posterior rim without submedian teeth and the lateral angles very obtuse; posterior face nearly vertical, and strongly sculptured. Dorsum with short, strong, oblique humeral carinæ, but without indication of longitudinal costulæ otherwise; entire surface deeply, sharply, minutely foveolate, the foveolæ mostly somewhat elongate; this sculpturation becomes a coarse rugose-puncturation on extreme apex. Abdomen scarcely as long as head and thorax together, viewed from side very gradually deepening to the not strongly rounded apex; the ventral concavity extends to apex, and here the ovipositor (in this specimen) is exserted to more than half the length of abdomen, the hypopygium extended considerably beyond apex. The second joint of maxillary palpi is strongly, subangularly dilated at middle. Antennæ 25-jointed, the scape rather strongly swollen at middle and reaching lateral ocelli; the flagellum much stouter on apical half, then suddenly attenuate to apex. First abscissa of radius but slightly longer than second, second subequal to second transverse cubitus; third abscissa slightly upcurved. Nervulus postfurcal to one-fourth first abscissa of discoidal.

Botany Bay, New South Wales (*Petersen*).

This species has the appearance of an ordinary small *Chelonus*, but is very distinct in the details of structure.

Ascogaster laeviventris sp. nov.

Length, female, 2.5 millimeters.

Black, with very scant pubescence. Antennæ piceous, the scape, annellus, and first joint of flagellum dark ferruginous beneath. Legs sordid stramineous, all the femora except more or less at apex and base of each, and hind coxæ piceous; middle tibiæ darker apically; hind tibiæ and tarsi piceous. Wings hyaline, slightly infumated beneath stigma, the veins nearly concolorous, paler than stigma, second transverse cubitus decolored. Tegulæ sordid stramineous.

Clypeus with sparse, coarse punctures, its anterior border somewhat extended and reflexed, also narrowly arcuate. Face coarsely rugose-punctate, the trend of rugæ being downward and mesad; basal half with a distinct median ridge, but this not continued between antennæ; the face much wider between orbits than long from antennal sockets to clypeus. Vertex and scrobal depression uniformly transversely rugose-punctate, without longitudinal rugæ next orbit. Vertex not at all concave, the ocellocular distance but slightly more than ocellar width. Scapes rather short and thick, not reaching lateral ocelli. Mesonotum with entire basal depressed area occupied by small, crowded areolæ, which are shortly extended along lines of notauli, the remainder of surface covered with very large adjoining punctures. Scutellum sexfoveate at base, median area sparsely punctured. Mesopleuræ sparsely punctate, hind border margined with a single row of very uniform foveolæ.

Propodeum reticulate-foveate, the narrow median area with strongly raised margins; submedian and lateral dentations very obtuse, hardly evident. Dorsum with the two short oblique humeral carinæ strong, the entire remainder of surface of basal two-thirds covered by fine, crowded, longitudinal reticulating rugosities, these obsolescent on apical third which is smooth and shining.[10] Viewed from side, abdomen much shorter than head and thorax, becoming very gradually deeper apically, the ventral concavity broadly extended to apex, where the ovipositor projects about one-fourth length of abdomen. Antennæ broken beyond fourteenth joint, but thus far stoutly terete. First and second abscissæ of radius and second transverse cubitus subequal in length; third abscissa of radius straight. Nervulus postfurcal to a little more than one-fourth length of first abscissa of discoidal.

Botany Bay, New South Wales (*Petersen*).

One specimen of this unique species. One of the most distinct of many new forms discovered by Mr. Petersen.

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[10] A condition not noted elsewhere in this tribe in such extreme development.

Ascogaster cinctus sp. nov.

Length, female, 3 millimeters.

Black; basal third of abdomen stramineous, the hind margin of this colored area transversely straight. Basal half of antennæ ferruginous, apically piceous. Legs stramineous; all femora and hind coxæ largely piceous, as well as hind tibiæ except at base and hind tarsi. Wings palely infuscated, more deeply so beneath the stigma, veins mostly as dark as stigma; proximal point of stigma bright stramineous and from this a narrow white band extends across the wing to outside the second abscissa of discoidal nervure. Tegulæ stramineous.

Clypeus smooth and shining, with few widely separated punctures, anterior margin narrowly arcuate. Face much broader than long, thickly coarse punctate with no indications of rugæ, at extreme base a thin sharp median carina which extends between antennæ, and from this to clypeus a broad, low, irregular ridge. Scrobes very short and broad, near to sockets very deep and nearly smooth, above rugose-punctate like the vertex; with several irregular, fine, longitudinal rugæ between scrobes and orbits. Vertex not concave, ocellocular distance slightly greater than width of ocellar area. Genæ broader throughout in side view than eye, very coarsely, somewhat sparsely punctured, malar area long, nearly equaling width of eye. Mesonotum with median basal area minutely, irregularly foveolate; the notauli are deeply suddenly impressed throughout, and connected basally by an arcuate impression; remaining surface densely, coarsely punctured. Scutellum sexfoveate basally, the disk coarsely, but smoothly, longitudinally rugose-punctate. Propodeum irregularly fine areolate, the median area of usual form, narrow, but with a strong complete median carina, and with several complete, oblique, stronger rugæ on lateral area; submedian and lateral teeth not evident; posterior concave face very strongly sculptured. Mesopleura coarsely, irregularly punctured, somewhat rugosely so below. Dorsum with humeral carinæ strong, straight and very close together, distance between them being only one-third of basal width of dorsum; entire surface to near apex very finely longitudinally reticulate-rugose; extreme apex smooth and shining. Abdomen shorter than head and thorax together, viewed from side very gradually deeper to the rather narrowly rounded apex, ventral concavity widely extended to the very apex; ovipositor entirely retracted in this specimen. Maxillary palpi with both second and third joints strongly swollen. Antennæ broken beyond twelfth joint, stoutly terete but evidently somewhat enlarged on apical third. Second abscissa of radius slightly longer than first and distinctly longer than second transverse cubital; third abscissa of radius distinctly arcuate. Nervulus postfurcal to one-third of first abscissa of discoidal.

Ebor (about 1,500 meters altitude), New South Wales (*Petersen*).

Resembling *A. laeviventris* in some respects, but distinct in size, coloration of wings, and other details. Possibly this species may be closer to *A. novoguineensis* than to any other. The form of the scrobes in this species tends toward that of the Malayan species.

Ascogaster detectus sp. nov.

Length, male, 2.5 millimeters.

Black; head pale ferruginous with exception of eyes and ocellar area, the mandibles unicolorous; scape pale ferruginous, flagellum shading into very dark ferruginous apically; legs entirely straw yellow, the hind tibiæ and tarsi slightly darkened apically. Abdomen with about basal half straw yellow, the terminal boundary of this area in the type rather irregular. Wings hyaline, veins all much paler than the dark brown stigma. Tegulæ sordid stramineous.

Clypeus shallowly, coarsely, and rather sparsely punctured, distinctly transverse and with anterior margin narrowly arcuate. Face much wider than long, the surface longitudinally impressed submedially, rather shallowly, finely rugose-punctate, the trend of rugosities being downward and mesad. Scrobes deep, but very short and broad, separated below by a delicate median carina, the inner surface like the entire vertex very finely, transversely rugulose with scattering punctures. Lateral ocelli very large, about twice size of anterior, the three subequidistant; ocellocular distance about equaling width of ocellar area. Sides of head long behind eyes, but rapidly incurved to occiput; in direct dorsal view the face is roundly somewhat protuberant before eyes. Mesonotum very coarsely, irregularly punctate on median basal area, less strongly and more sparsely punctate elsewhere, the lines of notauli somewhat impressed. Scutellum basally sexfoveate, the disk shining and very sparsely minutely punctured. Propodeum with very large, irregular, shallow areolæ which are coarsely, confluently punctured within; median area not separated; submedian and lateral teeth lacking. Disk of mesopleura coarsely, confluently punctured above, sparsely punctate and shining below. Dorsum with humeral carinæ strongly oblique; surface finely, thickly, longitudinally reticulate-rugose; entire apex smooth and shining. Viewed from side, abdomen is distinctly shorter than head and thorax together, gradually deepening posteriorly to the rounded apex; ventral concavity broadly extended to very apex. Antennæ broken beyond eighteenth joint, but terete throughout. First abscissa of radius slightly longer than second, but scarcely as long as second transverse cubital, the third abscissa slightly incurved. Nervellus postfurcal to about one-fourth of first abscissa of discoidal.

Botany Bay, New South Wales (*Petersen*).

Very close to *A. tricolor* Szepligeti, described from Mount Victoria, New South Wales, but much smaller, with the opaque vertex thickly, transversely rugulose and little punctate, the legs entirely pale yellowish, etc. Szepligeti's descriptions are too brief to make a detailed comparison possible. He speaks of the clypeus of *tricolor* as "rundlich" but it is undoubtedly transverse as in all other species.

Ascogaster vividus sp. nov.

Length, male, 3 millimeters.

Black; head vivid light ferruginous; mandibles darker at tips; scape concolorous with head, but flagellum piceous. Fore and middle legs pale ferruginous; hind legs largely piceous except trochanters and bases of tibiæ. Wing somewhat infumated, strongly so beneath the dark stigma; veins paler than stigma; from between stigma and prestigma a narrow pale band extends across the wing as in *A. cinctus*, but not white as in that species nor involving stigma. Tegulæ ferruginous.

Clypeus sparsely coarse punctate, the anterior margin narrowly subtruncate at middle; basal suture very strongly arcuate. Face thickly, coarsely punctured, with a few indistinct rugulæ next orbits; surface basally with two broad shallow submedian longitudinal impressions, which leave between them at base a very short, blunt, median ridge. Scrobes throughout with thick, concentrically transverse rugulæ and very sparse punctures, and no bounding rim except at sockets. Vertex transversely rugulose, with sparse punctures; the ocellocular distance a little greater than over-all ocellar width; the ocelli subequal in size, the distance between posterior much greater than to anterior; face slightly broadly protuberant before eyes. Entire depressed basal area of mesonotum with small irregular but distinct areolæ, which are narrowly extended along lines of notauli; remainder of surface thickly coarsely punctured. Scutellum septemfoveate at base, the disk smooth and shining and with few minute punctures.

Propodeum with a semicircular rimmed median area on posterior half of upper surface, the basal half represented only by a strong median carina; lateral to this occur several strong oblique rugæ; the surface otherwise with small irregular areolæ; posterior rim without teeth; terminal concave face strongly sculptured. Disk of mesopleura in large part with small irregular areolæ, lower posterior part smooth and shining. Dorsum with the rather long and strong humeral carinæ parallel on disk of basal third; remainder of surface thickly, sharply, longitudinally, reticulately rugulose, with sharply defined, small angular areolæ on the apical third; on extreme apex these become thick, oblique, irregular rugulæ. Viewed from side the abdomen is distinctly shorter than head and thorax together, rather rapidly deepening to the broadly rounded apex; ventral concavity broadly extended to very apex. Antennæ with scapes rather short and thick; flagellum broken beyond twenty-third joint, all joints teretely elongate; even in this broken condition nearly as long as body. First abscissa of radius much longer than second, or than second transverse cubital; third abscissa of radius rather strongly incurved. Basal vein, second abscissa of cubitus (especially distad), and first abscissa of radius strongly broadened. Nervellus postfurcal to about one-fourth of first abscissa of discoidal.

Illawarra, New South Wales (*Petersen*).

Szepligeti described only one red-headed *Ascogaster* (*A. tricolor*) from Australia. It now appears certain that there is a group of species in Australia closely related to *A. tricolor*. The matter is greatly complicated, not only by the very incomplete description of *A. tricolor*, but also by the great difficulty of distinguishing and properly associating the sexes, with the scant and imperfect material now at hand. The genitalia in all of these species are closely retracted and, though the ventral concavity in all extends in full width to the apex, still examination is very difficult without dissection. Also, most of the other genera do not show the very striking sexual differences so apparent in the antennæ of many *Chelonus* and described by Marshall long ago. There is here, therefore, the greatest need for collecting large series, as has been done with many Malayan species in other groups. So far, all species of this genus have come to us in very few specimens.

A single specimen with broken antennæ, also from Illawarra, may be the female of this species. While the general appearance of the insect is very similar, the differences in detail are sufficient to make this reference a tentative one until more material shall have been obtained. It differs from the male as follows:

Length, female, 3.25 millimeters. Head less brightly ferruginous. Wing less strongly infumated and the hyaline cross-band less conspicuous. Hind legs pale yellowish like the others. Abdomen with basal third suffused, very dark ferruginous, this coloration very inconspicuous. Tegulæ pale stramineous.

Clypeus with broad median portion of basal suture straight, not at all arcuate; disk smooth and shining with very few minute punctures. The basal areolate area of mesonotum narrower. Scutellum with larger and somewhat more numerous punctures. First abscissa of radius subequal to second abscissa and to second transverse cubitus.

Ascogaster distinctus sp. nov.

Length, female, 3 millimeters.

Differs from *A. vividus* as follows: The ferruginous of head less vivid. Inner surface of scapes darkened. Legs all very pale ferruginous except tips of hind tibiæ and hind tarsi which are piceous. Wing less strongly infumated and with transverse hyaline band less conspicuous; tegulæ stramineous. Abdomen with basal third clear stramineous.

Clypeus nearly smooth, with very few punctures. Face without appreciable rugulæ near orbits. On depressed basal area of mesonotum a sharp, strong, median carina, the areolæ on either side of this showing a distinct tendency to longitudinal arrangement. Scutellum with only four very large foveæ at base, the disk covered with large punctures separated by at least their own diameter. Ovipositor very shortly exserted in this specimen. Antennæ broken beyond the twenty-sixth joint. Basal vein not evenly arcuate, suddenly bent near base, then straight to prestigma.

Illawarra, New South Wales (*Petersen*).

Very close to *A. vividus*, but distinguished by differences in clypeus, mesonotum, and scutellum. While material at hand does not furnish any basis for estimating the range of variation in this group, still it seems that this form cannot be associated with the female above tentatively referred to *A. vividus.*

Ascogaster maculaticeps sp. nov.

Length, male, 3.5 millimeters.

Black; head and legs nearly of same shade of pale ferruginous; nearly entire vertex, to very near orbits, black; hind tibiæ nearly white on basal half. Wings slightly infumated on distal half, with a very faint indication of the transverse hyaline band of other members of this group. Veins somewhat paler than the dark stigma, the median much paler. Tegulæ stramineous.

Differing from *A. vividus* in structure as follows: Clypeus nearly as thickly coarse punctate as the face. Face very short, the blunt median ridge extending to clypeus. The sharp, strong, transverse rugulæ of vertex interspersed with large punctures, these denser behind ocelli. Notauli distinctly foveolate nearly to anterior border of mesonotum. Scutellum quinquefoveate at base, the disk covered by large punctures which are mostly not separated by as much as their diameter. Propodeum with the median area larger and somewhat longer, and the basal median carina therefore shorter, the lateral areolation much stronger, with rims of areolæ sharply raised, and without lateral oblique rugæ. Mesopleuræ with very large punctures, these larger and coalescent above; a deep, curved, longitudinal, somewhat oblique impression extends from middle of fore margin caudad and downward to hind margin, this broad groove being occupied throughout by vertical foveolæ. Dorsum with the small, sharply defined, apical areolæ occupying nearly all of apical two-thirds. Antennæ 27-jointed and a little longer than the entire body. First abscissa of radius equal to second and these each slightly longer than second transverse cubital, and with first transverse cubital and second abscissa of cubitus swollen to greater diameter than other veins. Nervulus a little longer postfurcal.

Botany Bay, New South Wales (*Petersen*).

This is the most distinct species among the red-headed forms, widely separated, inter alia, by the broad discal groove of mesopleura.

Genus CASCOGASTER novum

This group, as characterized in the above generic synopsis, presents a greater departure from normal *Ascogaster* than has yet been indicated by any author for this assemblage. The position of the median ocellus is distinctive. The head is more swollen and more approaching subcubical than in *Ascogaster.* The character of the sculpturation is likewise unique.

In 1919, Fullaway described a species from Java[11] (*rugosa*) which he placed in *Ascogaster,* and which evidently pertains to *Cascogaster.* It exhibits the characteristic position of ocelli, and the first discoidal cell is described as "petiolate," which evidently refers to the very distinctive origin of the cubitus on the basal vein considerably below the prestigma. Fullaway does not, however, mention any special formation of protuberant denticles in any part of the margins of scrobes—a very conspicuous development in each of the three species now at hand.

Type *C. fullawayi* sp. nov.

Synopsis of species of Cascogaster g. nov.

MALES

a^1. Abdomen ovate oblong in outline (dorsal view), widest at middle, the narrowing to the short acute apex confined to apical third; abdomen black.
  b^1. Length, 3 millimeters; nervellus "almost interstitial." **C. rugosa** Fullaway.
  b^2. Length, 4 to 4.25 millimeters; nervellus postfurcal to at least one-fourth of first abscissa of discoidal.
    c^1. Face with a strong laminate prominence at middle; lateral scrobal rims at middle extended into high, strong teeth which are higher than sockets and very conspicuous; first abscissa of radius a little longer than second; length, 4 millimeters. **C. fullawayi** sp. nov.
    c^2. Face medially carinate but without strong prominence at middle; lateral scrobal rims inconspicuously obtuse angulate at middle; first abscissa of radius distinctly shorter than second; length, 4.25 millimeters........ **C. malayensis** sp. nov.
a^2. Abdomen long triangular in outline, widest at base, the narrowing to the long acute apex beginning on basal third; the color of abdomen very dark ferruginous; scrobal teeth of great size and very prominent; length, 3.5 millimeters........ **C. coelioxoides** sp. nov.

Cascogaster fullawayi sp. nov.

Length, male, 4 millimeters.

Black; antennæ and fore and middle legs very dark ferruginous, the tarsi paler; hind legs with coxæ black, femora and tibiæ piceous. Wings palely infuscated, much more darkly so in apical half of first cubital cell, and all of second cubital and radial cells, this coloration bordered basally by a hyaline line passing from prestigma obliquely through middle of first cubital cell. Palpi pale yellowish; mandibles black, with dark ferruginous tips, tegulæ very dark ferruginous.

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[11] Journ. Straits Asiat. Soc. 80 (1919) 48.

Clypeus strongly and subangularly arcuate basally and apically, the surface smooth and shining and sparsely, minutely punctured. Face with length about three-fourths of width, surface completely covered by large, deep, sharp-rimmed areolæ; at center of median line a very short, high laminate carina; from the high, raised, outer angles of antennal sockets several strong rugæ extend downward and toward center of face; centrally and above these rugæ, the areolæ are smaller. Between the antennæ a very high and very thin laminate median carina. Inner orbits parallel. Scrobes smooth and shining within, but with coarse, widely separated, transverse wrinkles; scrobes outwardly margined by high, thin, complete carinæ which near the middle are raised into sharply angulate teeth; outside these rims are several very large and very deep areolæ with smaller ones next orbits. Vertex entirely coarsely areolate. Eye of usual form but small, the malar space nearly as long. Genæ of great and subequal width throughout, nearly twice width of eye, the surface obliquely areolate, the blunt, low rims thick and bearing scattering, minute punctures. From above, the thick head has the very strongly white pubescent face scarcely at all prominent, but conspicuously marked by the lateral scrobal teeth, the high, sharp-rimmed, and very prominent antennal sockets, and the central facial lamina which is clearly visible in dorsal view. Mesonotum entirely covered by large, subequal, deep, sharp-rimmed areolæ of irregular arrangement, the position of notauli obscurely marked by broad, shallow, oblique impressions. Scutellum trifoveate basally, the disk with a high, sharp, median ruga and two lateral rugæ on either side, between these ill-defined areolæ. Pleuræ and propodeum sculptured like the mesonotum, but even more coarsely so, the transverse posterior rim of latter with submedian and lateral teeth very large, obtuse-angular, and strongly protuberant, the upper face of propodeum medially very short. Dorsum with the short humeral carinæ very strong and oblique; entire surface deeply sculptured with small longitudinal areolæ, these having within them many smaller, rounded areolæ. Hind coxæ distinctly transversely rugose-punctate. Abdomen acute apically, its extreme apex with a short acute teatlike extension; viewed from side the depth is but little greater subapically than basally, the ventral concavity extending but two-thirds of ventral length. Antennæ 41-jointed, a little longer than entire body, scapes rather slender, reaching behind ocelli; flagellum somewhat thickened on middle third, the tips strongly attenuate, the basal joints elongate and terete, from tenth to near end very short and as broad as long or but little longer. Wing with both first abscissa of cubitus and first abscissa of discoidal strongly bisinuate. First abscissa of radius slightly longer than second which equals second transverse cubitus; the third abscissa of radius straight. Nervulus postfurcal to one-fourth length of first abscissa of discoidal, the intervening portion of discoidal markedly thickened.

Baguio, Benguet Subprovince, Northern Luzon (*Baker*). Another specimen from a not-distant mountain locality, Imugan, Nueva Vizcaya Province (*Baker*).

Cascogaster fullawayi var. **maquilingensis** var. nov.

A specimen that does not appear to represent more than a varietal form of this species was taken on Mount Maquiling, in central Luzon, which locality is separated from the mountain localities of the typical form by the broad interior plains of central Luzon. This variety differs from the typical form as follows:

Clypeus with sparse but large punctures. Face with the high interantennal lamina, and the median facial prominence, connected by a distinct median carina which also extends to clypeus. Scutellum quinquefoveate at base, the disk with about six irregular subequal longitudinal rugæ.

Cascogaster malayanus sp. nov.

Very similar in general habitus to *C. fullawayi*, but differing as follows:

Length, male, 4.25 millimeters. Antennæ with scape and basal half of flagellum pale ferruginous. Fore and middle tibiæ with piceous shadings.

Clypeus of similar form basally but with apical margin broadly arcuate, its surface thickly, coarsely punctate. Face with a strong, even, percurrent median carina which lacks any raised laminate prominence at middle. The interantennal lamina is here developed into a stout, acutely triangular tooth (frontal view) which is medially carinate to its apex. Face nearly as long as broad, the surface areolæ smaller and therefore much more numerous. The sharp, high lateral rims of scrobes obtuse-angularly raised at middle, but not forming erect, acute teeth.

Malar space not as long as the eye. Genæ very broad below, but distinctly narrowing above. Notauli more narrowly and strongly depressed, median rugæ forming a very strong, complete median carina which is highest and strongest at base and bordered on either side by regular rows of areolæ. Scutellum with three very large foveæ at base, the middle one very large and deep and with its sharp lateral rims continued caudad across entire length of disk, the surface otherwise irregularly shallowly rugose. Antennæ broken beyond twenty-eighth joint. First abscissa of radius a little shorter than second, subequal to second transverse cubital; third abscissa of radius very slightly incurved.

Singapore (*Baker*).

This species is apparently closely related to the "*Ascogaster*" *rugosa* of Fullaway. The original description of that species is largely devoted to form of sclerites and similar characters, most of which are common to the whole genus, or tribe, or subfamily, while specific details of sculpturation and conformation are not mentioned. It is therefore impossible to make any satisfactory comparison. However, the length given for *rugosa*, 3 millimeters, would separate it from either *fullawayi* or *malayanus*. The nervellus of *rugosa* is also described as "almost interstitial," while in the other species known it is strongly postfurcal. Fullaway makes no mention of the various modifications of antennal sockets and scrobal rims which occur in these species, and which will also doubtless be found in some form in *rugosa*. Whether these conspicuous modifications are sexual or not is uncertain, but there is no such development in any true *Ascogaster* of Malaya or Australia, so far as known.

Cascogaster coelioxoides sp. nov.

Length, male, 3.5 millimeters.

Black, with the abdomen throughout a very dark ferruginous. Antennæ pale ferruginous, darker on apical third. Fore and middle legs sordid ferruginous, hind legs piceous. Wings colored as in the other species, but even more strongly infumated. Tegulæ ferruginous. Mandibles ferruginous, darker at tips.

Differing from *C. fullawayi* in structure as follows: Face with a high, sharp, even median carina on upper half, which reaches to apex of interantennal denticle. Lateral scrobal rims at middle projected vertically in very large, broad, subtruncate-tipped teeth, which project beyond the appressed scapes and which are conspicuously visible in both dorsal and ventral views. Areolæ of vertex and thorax of great size and depth. Notauli indicated only at sides of mesonotum by narrow impressions, scutellum trifoveate at base, the disk irregularly small areolate. Propodeum deeply depressed between the very large submedian teeth. Dorsum with the short humeral carinæ very wide apart, nearly parallel, between them with very large, high-rimmed, longitudinal areolæ; remainder of surface with smaller areolæ of the same type but with the thin rims bulging around frequent large punctures borne on their edges. While the abdomen above is strikingly different in outline, as indicated in the above synopsis, the lateral view is not dissimilar to that of *fullawayi*, though the very acute apex appears as a more extended teatlike projection. First and second abscissa of radius subequal and a little longer than second transverse cubital; third abscissa of radius straight. Nervellus postfurcal to one-fifth of first abscissa of discoidal. Antennal scapes small, scarcely reaching ocelli, and rather narrow, their surfaces shagreened, and coarsely, sparsely, shallowly punctured.

Singapore (*Baker*).

This remarkable species has quite the form of a minute female *Coelioxys*. It will be of the greatest interest to secure the female.

Genus MEGASCOGASTER novum

With the cyclostomine genus *Gastrotheca* standing in the Cheloninæ, there are a few Malayan species which would be thrown into it by current synopses. Apparently one of these has been described as *Gastrotheca sumatrana* by Enderlein,[12] though this transfer cannot now be substantiated. These species agree with *Gastrotheca* in some of the venational characters used in current synopses, but the fact that the Malayan forms are noncyclostomine and the nervellus is always postfurcal (usually far) shows that the Malayan forms have no relation to the African *Gastrotheca*. Certain females in several genera of true Cheloninæ have the abdomen apically bidentate, but this is a sexual character not occurring in all the species, even of the same genus. It seems quite doubtful, however, that the *Gastrotheca sumatrana*, with apically bidentate carapace, pertains to this group at all. It may belong to *Megachelonus*, where similarly armed females are found.

Megascogaster is unique in form of body, sculpturing, propodeal characters, and venation.

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[12] Stett. Ent. Zeit. 66 (1905) 236.

Megascogaster elongatus sp. nov.

Length, male, 5.5 millimeters.

Black, head and thorax with rather extensive smooth shining areas. Antennæ basally pale ferruginous, becoming piceous on apical three-fourths. Mandibles dark ferruginous. Fore and middle legs pale yellowish; hind legs dark ferruginous with base of coxæ, tibiæ, and tarsi piceous. Wings hyaline, stigma dark brown, veins with prestigma, pale stramineous. Tegulæ stramineous.

Clypeus and face smooth and shining, with sparsely set large punctures. Clypeus large, the basal suture very strongly arcuate, anterior margin obtuse-angularly extended, the apex notched. Face distinctly broader below than above, a little wider than long, with narrow, longitudinal impressions either side of median line, the lateral areas rather strongly bulging, and with a strong median carina on basal half, which is highest between antennæ and which separates scrobes. Scrobes with lateral rims high and sharp throughout, and between these and orbits a single very strong, sharp, longitudinal ruga; inner surface of scrobes smooth and shining. Outline of head from above transverse subrectangular, the genæ very strongly developed behind eyes and the width across genæ about as great as that across eyes. Ocellar area and ocelli relatively very small; ocelli subequidistant; ocellocular distance much greater than over-all ocellar width. Surface of vertex smooth and shining, sparsely coarse punctate, with a few small irregular areolæ in front of lateral ocelli. Malar space more than half length of the large eyes. Genæ very broad below, narrower above, smooth and shining, sparsely coarse punctate. Mesonotum of the rather short, anteriorly broadly rounded type, basal depressed area with very large, transverse, rather regularly arranged areolæ which are deep, sharp-rimmed, and within more or less subdivided; remainder of surface smooth and shining and sparsely coarse punctate; course of notauli indicated by lateral extension of small areolæ, the rows of which curve strongly downward to the sides.

Scutellum sexfoveate basally, the disk smooth and shining and sparsely coarse punctate. Propodeum covered by very large, deep, sharp-rimmed areolæ, a median area represented by a longitudinal row of three larger areolæ, which extend full length of upper face; hind margin of upper face sharp-rimmed, but nearly truncate, and without either submedian or lateral teeth.

Dorsum with the short humeral carina straightly parallel and as far from each other as from lateral margins, between these three longitudinal costulæ, and outside three or four more; the costulæ extend two-thirds length of dorsum, between them numerous small, elongate, compound areolæ; beyond this broken up into a thick-set maze of small areolæ, these becoming obsolete on the shining teatlike apical extension. The abdomen is longer than head and thorax together, very narrow, subparallel-sided, narrowed on the apical fourth to the teatlike apex; viewed from the side of subequal depth throughout, the ventral concavity extending to three-fourths the length. Mesopleura obscurely areolate above, smooth and sparsely punctate below, traversed by a broad and deep longitudinal median groove, which is transversely areolated. Antennæ 33-jointed, slender, terete, the tips slenderly attenuate; scapes very small and short, not surpassing anterior ocellus, but the annellus longer than wide. First abscissa of radius subequal to second transverse cubitus, these both distinctly shorter than second abscissa; third abscissa straight. First transverse cubitus strongly upcurved toward the stigma. Nervellus very shortly postfurcal. Second discoidal cell unusually large and long, subrectangular.

Female, length, 6 millimeters; very similar in all respects to male and with same form of abdomen, clypeus, scrobes, etc. Also, coloration is practically identical. The sides of abdomen are not parallel, but outcurved slightly. The slender ovipositor (not valves) is exserted in this specimen to one-fourth length of abdomen.

Dapitan, northwestern Mindanao (*Baker*).

Very fortunately, the two specimens taken of this fine species represent the two sexes, and the very close similarity of the two sexes is noteworthy—a condition totally different from that found in *Megachelonus*, for instance.

NOTES ON ORIENTAL DIPTERA, WITH DESCRIPTIONS OF NEW SPECIES

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ONE TEXT FIGURE

In this paper are presented descriptions of some new genera and species of Diptera, mostly from the Philippines, and notes on some previously described species which are imperfectly known. The new genera are strikingly distinct from any previously described in their respective families; the outstanding characters are plainly indicated under each. Where several species of a genus are described a synopsis of the species involved is given to facilitate their identification.

DROSOPHILIDÆ

Genus **LUZONIMYIA** novum

Generic characters.—Arista with short hairs above and below, the longest not much longer than its basal diameter; face not carinate; ocellar bristles represented by a pair of microscopic hairs in transverse line with anterior ocellus; postverticals short; all three orbitals distinct, the proclinate pair in front of and in line with the anterior reclinate pair; mouth margin slightly produced, vibrissæ very small. Thorax without a humeral bristle, the mesonotum otherwise as in *Drosophila*, the prescutellar pair of acrostichals strong, situated proximad of the posterior pair of dorsocentrals; sternopleura with two long bristles. Fore tibia without a preapical bristle. Wing as in *Drosophila*.

Genotype, the following species.

Luzonimyia nigropuncta sp. nov.

Female.—Head black, densely whitish gray pruinescent; antennæ testaceous yellow, third segment largely darkened; palpi black. Thorax black, densely pale gray dusted; apical margin of scutellum testaceous yellow. Abdomen testaceous yellow, tergites from third visible one to apical each with a pair of round, deep black spots on disk. Legs testaceous yellow. Wings clear. Halteres pale yellow.

Frons fully 1.5 times as long as wide, without fine surface hairs; eyes descending to almost extreme lower margin of head, the cheek subobsolete. Thorax with about ten series of intradorsocentral hairs; scutellum flattened on disk, bare. Legs as in normal species of *Drosophila*. Inner cross vein a little before middle of discal cell; first costal section about one-fifth as long as second, and about 1.5 times as long as third; penultimate section of fourth vein about four-fifths as long as ultimate, the latter deflected apically so that the first posterior cell is gradually widened to apex; outer cross vein at about two-thirds of its own length from apex of fifth vein.

Length, 2 millimeters.

Type, Mount Maquiling, Laguna Province, Luzon (*Baker*).

This genus has much in common with *Aclotoxenus* Frauenfeld, but the latter has but one pair of dorsocentrals, and differs in several other respects.

AGROMYZIDÆ

Ochthiphila luzonensis sp. nov.

Female.—Head black, densely gray dusted; antennæ and palpi orange yellow, third segment of former a little darker around apex. Thorax and abdomen black, densely gray dusted, former not vittate, the abdomen with an opaque deep black spot on each side of each tergite, not visible from above on the basal segment but becoming progressively more obvious apically, and on the apical two or three segments connected with a spot on each side of disk by means of a transverse black streak. Coxæ and femora fuscous, with gray dusting; tibiæ and tarsi orange yellow. Wings whitish hyaline, veins pale at bases, dark at apices. Halteres whitish yellow.

Frontal bristling normal, the postverticals a little shorter than the ocellars; upper apical angle of third antennal segment quite pronounced. Presutural intradorsocentral area with two widely separated series of fine short hairs; basal pair of scutellar bristles shorter than apical pair. Femora as usual rather stout. Inner cross vein at middle of discal cell.

Length, 3 millimeters.

Type, Mount Maquiling, Laguna Province, Luzon (*Baker*).

This species is distinguished from its allies by the markings of the abdomen, the short basal scutellar bristles, and the color of the antennæ and palpi.

GEOMYZIDÆ

Genus **TENUIA** novum

Generic characters.—Ocellars and postverticals long, the former divergent, the latter convergent; the four verticals long; each orbit with three bristles, all backwardly directed, the upper one curving a little outwardly; face narrowest at middle, central part concave below, tumid at the upper extremity, the central upper part with some microscopic hairs; a distinct fovea below each antenna which tapers off at vibrissa; cheek narrow, with a series of setulæ along middle to the long vibrissa; proboscis stout; palpi normal. Thorax with 1 + 4 long pairs of dorsocentrals, one humeral, one posthumeral, two notopleurals, one supraalar, one pair of prescutellar acrostichals, one sternopleural, one long and one short postalar, and one propleural; basal pair of scutellar bristles very short. Legs long, tibiæ and tarsi slender, preapical tibial bristle minute. Auxiliary vein fused with first at its apex; costa with short but distinct bristles from beyond first vein to apex of second; sixth vein thick, abruptly discontinued at about three-fourths of the distance to margin of wing.

Genotype, the following species.

Tenuia nigripes sp. nov.

Female.—Head black; frons brown, becoming yellowish anteriorly; entire orbits, including postocular, whitish yellow; cheek with a black mark posteriorly; face the same color as orbits, the foveæ black; antennæ and arista black, the former reddish below; palpi brown. Thorax and abdomen black, slightly shining, sparsely gray dusted, dorsum of thorax with traces of three dark vittæ, and the humeri, lateral margins of mesonotum, margin of scutellum, upper part of hypopleura, and the vertical mesopleural suture yellow; the connecting membrane between tergites yellow, but sometimes hidden. Legs black, fore coxæ yellowish in front. Wings grayish. Fringes of calyptræ brown. Halteres yellow.

Eyes bare; third antennal segment not as long as wide; arista pubescent; cheek about one-sixth as high as eye; parafacials narrow. Dorsum of thorax with sparse hairs, that of scutellum flattened and with very few hairs. Abdomen with six visible tergites. Posteroventral bristles on fore femur present only apically; fore tarsus distinctly longer than fore tibia; hind femur with two apical short bristles, one anteroventral and one posteroventral. Wing about three times as long as its greatest width; first posterior cell narrowed a little to apex; inner cross vein a little beyond middle of discal cell and distinctly beyond apex of first vein; outer cross vein at less than its own length from apex of fifth vein.

Length, 4.5 millimeters.

Type, Baguio, Benguet Subprovince, Luzon (*Baker*).

This genus belongs to the Opomyzinæ and is distinguished from other genera in that subfamily that have presutural dorsocentrals by the immaculate wings, presence of postverticals, possession of three pairs of orbital bristles, the bare mesopleura, and minute preapical tibial bristle.

CHLOROPIDÆ

CHLOROPINÆ

Genus **CHALCIDOMYIA** de Meijere

Frey records six species of this genus from the Philippine Islands, but I have only two of these on hand at this time.

Chalcidomyia aeneiventris de Meijere.

One specimen, Mount Maquiling, Laguna Province, Luzon (*Baker*).

This species is distinguished from its congeners by the lack of an apical dark spot on wing, and the entirely blue-black thorax and abdomen.

Chalcidomyia apicalis de Meijere.

Four specimens, Mount Maquiling, Laguna Province, Luzon (*Baker*).

Distinguished from its congeners by the presence of an apical dark spot on wing, the entirely yellow legs, and the large yellow mark on apex of abdomen which begins near base of third tergite and extends to tip. I have been unable to distinguish any yellow mark on the sternopleura, such as de Meijere mentions in his description of this species.

MUSCIDÆ

PHAONIINÆ

Genus **HELINA** Robineau-Desvoidy

This genus is distinguished from *Dichaetomyia* Malloch by the bare prosternum, pteropleura, and third wing vein, and from *Helinella* and *Eumyiospila*, both of which are described in this paper, by the last character only.

There are several species before me, which can be distinguished by means of the following synoptic key.

Key to the species of Helina Robineau-Desvoidy.

1. Hind femur of male with rather dense soft long hairs on ventral surfaces basally, longest on posteroventral, the anteroventral surface with four or five long, strong bristles on apical third or fourth; thorax with four pairs of postsutural dorsocentral bristles; abdominal paired dorsal spots very conspicuous; fore tibia without a median posterior bristle; sternopleurals 2 + 2; hind tibia with a short posterodorsal setula basad of middle................ **H. hirtifemorata sp. nov.**

   Hind femur in neither sex with long ventral hairs; thorax with three pairs of postsutural dorsocentral bristles.. 2.

2. Sternopleurals 1 + 2; scutellum yellow, contrasting sharply with the brownish or black mesonotum, the latter with two narrow submedian and two broader sublateral dark vittæ, the sides of scutellum with short hairs below level of the strong bristles basally; palpi fuscous, apices sometimes faintly pale; fore tibia without a median posterior bristle, but with a setula near middle on anterodorsal surface; legs yellow, tarsi fuscous.. **H. coronata (Stein).**

   Sternopleurals 2 + 2; scutellum black, colored as mesonotum, and bare below the level of the strong bristles.. 3.

3. Fore tibia without a posterior median bristle; hind tibia without a posterodorsal bristle near base; eye facets of male larger than usual on upper half; anterior pair of presutural dorsocentral bristles not over one-third as long as the posterior presutural pair; inner cross vein of wing very obviously clouded................ **H. mindanaensis sp. nov.**

   Fore tibia with a median posterior bristle; hind tibia with a short posterodorsal bristle near base; eye facets slightly enlarged above; anterior pair of presutural dorsocentral bristles nearly as long as the posterior pair .... 4.

4. Legs in male tawny yellow, bases of fore, and sometimes of mid, femora darkened, tarsi black; abdomen hardly shining, densely gray dusted, with a pair of distinct, though small, dark subtriangular spots on tergites 2 and 3, and dark dots at bases of some of the long bristles. **H. flavidipennis (Stein).**

   Legs in male black, tibiæ and extreme apices of femora paler, sometimes tawny yellow; abdomen distinctly shining, evenly and rather thinly brownish dusted, without dark dorsal spots. **H. nigroabdominalis sp. nov.**

Helina hirtifemorata sp. nov.

Male.—Black, densely yellowish gray pruinescent. Face and orbits with dense silvery gray pruinescence; interfrontalia black; antennæ and palpi black. Thorax with four black dorsal vittæ that are not continued to hind margin and are most distinct when the thorax is seen from behind. Abdomen with three pairs of round black dorsal spots, one on each tergite from second to fourth, the pair of fourth least distinct, and sometimes a faint dark dorsocentral line. Legs black, knees yellowish;

tibiæ brownish. Wings clear, cross veins not distinctly clouded. Calyptræ and halteres yellowish.

Eyes bare; frons at narrowest point wider than third antennal segment; arista plumose. Thorax with 2 + 4 dorsocentrals, prealar minute, sternopleurals 2 + 2. Abdomen subcylindrical, the tergites with rather strong apical bristles; fifth sternite with only the usual hairs. Fore tibia without a median posterior bristle; mid femur with a few long bristles on basal half of posteroventral surface; mid tibia with about four posterior bristles; hind femur with rather dense long hairs on more than the basal half of ventral surfaces, about six long bristles on apical half of the anteroventral, and very long, closely placed, setulose hairs on posterior surface from base to one-third from apex, where they abruptly cease; hind tibia with one or two posterodorsal setulæ near base, three anterodorsal, and four or five anteroventral bristles. Costal thorn conspicuous.

Length, 6.5 millimeters.

Type, allotype, and six paratypes, Baguio, Benguet Subprovince, Luzon (*Baker*).

The female has, as usual, the frons fully one-third of the head width and, except for the lack of long ventral hairs on hind femur, is similar to the male.

Helina coronata (Stein).

I have before me two female paratypes of this species sent on loan by Dr. C. F. Baker, which agree perfectly with a female from Mount Maquiling. All three lack hairs on the hypopleura, while a series of both sexes from Sumatra, which appear to belong to this or a very closely allied species, have a few fine hairs both on the upper anterior margin and below the spiracle. All the specimens have short black hairs on sides and margin of ventral surface of scutellum basally, the dorsocentrals 2 + 3, the prealar bristle very short, arista plumose, and fore tibia with a short anterodorsal bristle near middle, but no median posterior bristle.

Helina mindanaensis sp. nov.

Male.—Black, densely yellowish gray pruinescent. Thorax rather inconspicuously quadrivittate with black. Abdomen with a pair of poorly defined, large, brown spots on each tergite from second to fourth, and faint brown dots at bases of the bristles. Legs fuscous, extreme apices of femora, and all of tibiæ, yellowish testaceous. Wings grayish hyaline, inner cross vein slightly clouded. Calyptræ and halteres yellowish.

Eyes with very short sparse hairs; frons not over the width of third antennal segment; arista plumose. Thorax with 2 + 3 dorsocentrals, the anterior presutural pair very short; prealar lacking; sternopleurals 2 + 2. Abdomen elongate ovate, rather strongly bristled apically, fifth sternite without exceptional bristling. Fore tibia without a median posterior bristle; mid tibia with two short posterior bristles; hind femur with three or four long preapical anteroventral bristles; hind tibia with one anteroventral and two anterodorsal bristles, no setula on posterodorsal surface near base. Last section of fourth vein over twice as long as preceding section.

Length, 5 millimeters.

Mindanao, Surigao Province, Surigao (*Baker*), type.

Helina flavidipennis (Stein).

I assign to this species a number of specimens that have the same general color as the preceding species, but the legs are honey yellow with black tarsi, and there is rarely a slight darkening of the bases of fore and mid femora, the abdomen in male is densely brownish gray dusted, with paired dark spots on tergites 2 and 3, and dark dots at bases of some of the larger bristles. The wings are distinctly yellow at bases, the costal spine is long, and the penultimate section of fourth vein is about two-thirds as long as ultimate section. All the dorsocentrals (2 + 3) are long, and the presutural acrostichal hairs are in two series.

Length, 6 to 9 millimeters.

Locality, Baguio, Benguet Subprovince, Luzon (*Baker*).

Helina nigroabdominalis sp. nov.

Differs from the preceding species only in being more uniformly black, the abdomen being a drab color without dark dorsal spots, at least in the male. Both species have at least one posterior median bristle on the fore tibia and one posterodorsal bristle near base on hind tibia.

Length, 6 to 9 millimeters.

Type, male, allotype, and nineteen paratypes, Baguio, Benguet Subprovince, Luzon (*Baker*).

It is possible that this is only a variety of the preceding species.

Genus HELINELLA novum

This genus is distinguished from *Helina* by the presence of some setulose hairs on the undersurface of third vein at base.

Genotype, *Mydaea propinqua* Stein.

I have before me two species of the genus which can be distinguished as follows:

Bases of tarsi broadly yellow; abdomen in neither sex yellow at base, the dorsal dark spots small, rather widely separated in middle of tergites.......... H. propinqua (Stein).

Tarsi entirely black or fuscous; abdomen in male broadly translucent yellow at base, the black dorsal spots very large and separated by a mere line on middle of tergites.......... H. otanesi sp. nov.

Helinella propinqua (Stein).

Male.—Black, slightly shining, densely brownish gray dusted. Face, cheeks, and orbits white dusted, interfrontalia black when seen from behind; antennæ and palpi black. Thoracic dorsum quadrivittate with black. Abdomen with central part of first tergite and two variable-sized and poorly delimited subtriangular marks on second, and another on third tergite, dark brown or fuscous, fourth tergite less evidently marked. Legs dusky testaceous yellow, coxæ and femora fuscous, apices of tarsi darkened. Wings brownish hyaline. Calyptræ and halteres yellowish.

Frons a little wider than third antennal segment, orbits setulose on their entire length, not obliterating the interfrontalia; arista plumose; parafacial in profile almost obsolete; cheek about 1.5 times as high as width of third antennal segment; palpi not much widened in male, distinctly widened in female. Thorax with 2 + 3 dorsocentrals, and sometimes a very short setula just behind suture; anterior pair of presutural dorsocentrals rather short; anterior intraalar absent or minute; prealar hardly distinguishable; scutellum bare on sides. Abdomen ovate, basal sternite bare, tergal bristles strong apically. Fore tibia without a median posterior bristle; mid tibia with two posterior bristles; hind femur with three to five preapical anteroventral bristles, and some setulose hairs on basal half of posteroventral surface; hind tibia with one anterodorsal and one anteroventral bristle. Fourth wing vein almost straight; last section of fourth vein about twice as long as the preceding section.

Length, 6 to 8 millimeters.

Localities, Cuernos Mountains, Occidental Negros; Mount Maquiling and Los Baños, Laguna Province, Luzon (*Baker*).

Some of the specimens are much smaller than others, but do not differ in other respects.

Helinella otanesi sp. nov.

Male and female.—This species is structurally similar to the foregoing, but can be readily distinguished from it by the characters given in the specific diagnosis. The female has the abdomen black at base but, like the male, it has the tarsi black, the abdominal dorsal spots very large, and the sublateral thoracic vitta broader and with a brownish suffusion along its sides.

Length, 8 millimeters.

Type, male, allotype, and two male paratypes, Laguna Province, Los Baños; female paratype, Mount Maquiling, Luzon (*Baker*).

I have before me a female from Sumatra that has the femora yellow, and which in some other respects does not agree exactly with the females of *otanesi;* but the material is insufficient to permit of a definite decision as to its specific identity.

The above species is dedicated to Faustino Q. Otanes, a very promising Philippine entomologist, in memory of my association with him in the United States.

Genus **EUMYIOSPILA** novum

This genus differs from *Myiospila* in having the fourth wing vein almost imperceptibly curved forward apically, the interfrontalia of the female without a pair of cruciate bristles, and the anterior intraalar bristle absent or minute. In both the species known to me the males have the anteroventral surfaces of the femora armed apically with a series of short, stout, closely placed, black bristles, least developed on the fore pair.

Genotype, *Eumyiospila spinifemorata* sp. nov.

There are two species of the genus known to me, the distinguishing characters of which are as follows:

Antennæ fuscous, apex of second and base of third segment yellowish, femora in both sexes honey yellow .... **E. spinifemorata** sp. nov.

Antennæ with the third segment entirely pale honey yellow; femora with a greater or lesser proportion of basal section black, sometimes to well beyond middle .... **E. contraria** Walker.

Eumyiospila spinifemorata sp. nov.

Male and female.—Head black, with white dusting, extreme apex of second, and base of third antennal segment yellowish; palpi black. Thorax black, rather densely gray dusted; humeri and scutellum testaceous yellow, the latter darkened at base, dorsum of thorax distinctly vittate; when seen from behind there are two broad vittæ along the lines of dorsocentrals, and two laterad of these which are broken at suture, but when the dorsum is viewed from in front the dark and light vittæ are transposed. Abdomen brownish, yellowish translucent at base, each tergite except the first with a pair of large black discal spots, least conspicuous on fourth. Legs yellow, coxæ and femora blackish. Wings yellowish, most noticeably so at bases. Calyptræ and halteres yellowish.

Eyes bare: frons in male as wide as third antennal segment, orbits setulose on their entire length; frons of female about one-sixth of the head width at vertex, gradually widened to anterior margin, the two upper bristles on each orbit directed backward, the median bristles short, anterior one very long; arista plumose; palpi hardly dilated in male, rather distinctly dilated in female. Thorax with 2 + 4 dorsocentral bristles, the anterior pair of postsuturals small but distinct; scutellum rather elongate, bare on sides; sternopleurals 1 + 2. Abdomen elongate ovate; basal sternite bare. Fore femur with one or two short preapical anteroventral bristles, the mid and hind pairs in same sex with a series of closely placed, short, stout bristles or spines on apical third or more of the same surface; femora of female without these short bristles, the hind pair with two or three longer, preapical, anteroventral bristles; fore tibia without a median posterior bristle; mid tibia with two posterior bristles; hind tibia with one anterodorsal and one anteroventral bristle. Fourth wing vein hardly curved forward apically.

Length, 7.5 to 9 millimeters.

Type, allotype female, and four female paratypes, Mount Maquiling, Laguna Province, Luzon (*Baker*); paratypes, two females, Fort de Knock, Sumatra, 1925 (*Jacobson*); males, Tandjunggadang, Sumatra (*Jacobson*); Peradenyia, Ceylon (*E. E. Greene*); Singapore (*Baker*); Siam, Sungkie (*H. C. Robinson and N. Annandale*); Pahang, Federated Malay States, December 5, 1921 (*H. M. Pendlebury*).

Eumyiospila contraria Walker.

Very similar to the foregoing species, differing essentially as stated in the above synopsis. Usually the anterior pair of postsutural dorsocentrals is even less developed than in the last species.

Localities, Mount Maquiling and Mount Banahao, Luzon; Surigao, Surigao Province, Mindanao (*Baker*).

Hebecnema nigrithorax Stein.

This species and the next have the characters of *Hebecnema*, except that there are one or two weak setulæ at the base of third wing vein as in *Mydaea* and the preceding genus. The rather protuberant frons at bases of the antennæ, with the lack of parafacials when the head is seen from the side, coupled with the long plumose arista, and the thoracic chætotaxy, are sufficient to justify their retention in *Hebecnema*.

The general color of *nigrithorax* is fuscous, with the base of arista, almost entire abdomen, and the tibiæ tawny yellow. The calyptræ and halteres are brown, and the wings evenly smoky.

The eye facets in male become gradually larger on the upper portion of eyes. Thorax with 2 + 4 dorsocentrals. Fore tibia without a median posterior bristle; mid tibia with two posterior bristles; hind femur with four or five preapical anteroventral bristles, the posteroventral surface bare; hind tibia with one anterodorsal and one anteroventral bristle.

The female has the frons at vertex about one-fourth of the head width, widened anteriorly, and each orbit with three anterior incurved bristles, and two upper bristles backwardly curved. The humeri are yellowish, and the abdomen fuscous except at base.

Length, 3.5 millimeters.

Many specimens from Los Baños and Mount Maquiling, Laguna Province, Luzon (*Baker*).

Hebecnema luzonensis sp. nov.

Male.—Black, shining. Arista yellowish basally, face and cheeks with whitish dusting. Thorax with brownish dusting, but not noticeably vittate. Abdomen when seen from the rear with brownish dusting and two pairs of elongate, black, submedian spots, one on second and the other on third tergite. Legs pitchy black, the tibiæ and tarsi more yellowish brown. Wings brownish. Calyptræ and halteres dark brown.

Eyes as in the last species, but the facets not so large above and while, as in that species, there are two pairs of orbital bristles in front, the width of the frons is at middle about equal in width to the third antennal segment and not a mere line, as in *nigrithorax*. The bristling of the thorax and legs is as in that species except that there are two or three long bristles at middle of posteroventral surface of hind femur.

Length, 3.5 millimeters.

Type, Mount Maquiling, Laguna Province, Luzon (*Baker*).

Genus **PICTIA** novum

Generic characters.—Frons in male about one-sixth of the head width, vertical and postvertical bristles of equal length, not half as long as the forwardly directed ocellar pair, orbits narrow, each with some inwardly directed bristles which become longer anteriorly; face slightly foveolate below base of each antenna, the upper central part therefore with a rather sharp carina; antennæ elongate; arista plumose; facial ridges with a series of microscopic hairs below; proboscis rather stout. Thorax as in *Helina,* but the prosternum haired on sides. Abdomen with rather strong bristles on apices of tergites. Legs and wings as in *Helina,* but the fourth vein with a very slight bend forward near apex.

Genotype, *Spilogaster xanthoceros* Walker.

Pictia xanthoceros Walker.

Head black, with white dusting, third antennal segment bright yellow. Thorax black, with conspicuous white-dusted markings, the dorsum when seen from behind with two black marks in front of suture on the lines of dorsocentrals, a broad transverse band behind suture, and the scutellum black; pleura with a broad, median, white, vertical mark. Abdomen black, narrowly yellowish on apices of tergites, second and third tergites each with a white-dusted basal fascia which is narrowly interrupted with black in middle, fourth tergite with only a narrow black central line, the broad black apical fascia of the other tergites absent. Legs black, tibiæ brownish. Wings hyaline, yellowish at bases and along costa. Calyptræ yellow. Halteres yellow with fuscous knobs.

Dorsocentral bristles 2 + 3, anterior presutural pair short; only one postsutural intraalar present; prealar short; sternopleurals three; hypopleura with hairs on lower posterior part, and quite noticeable hairs along the lower margin of the spiracle; scutellum bare on sides and below. Basal abdominal sternite haired. Fore tibia without a median posterior bristle; tarsi slender, longer than tibiæ; mid tibia with two posterior bristles; hind femur in male with short, fine, anteroventral bristles and a rather strong, short, posteroventral bristle about one-fourth from apex; hind tibia with a very fine short setula in the position of the calcar of *Phaonia* and its allies, and two or three short, fine anteroventral bristles.

Length, 8 millimeters.

Locality, Los Baños, Laguna Province, Luzon (*Baker*).

I have seen this species also from Sumatra.

Genus **PHAOMUSCA** novum

Generic characters.—Similar to *Polietes*, having the prosternum and upper margin of hypopleura in front of spiracle hairy, and the hind tibia with a bristle well beyond the middle on posterodorsal surface. The eyes are but sparsely hairy, the thorax has only one pair of acrostichals, the prescutellar pair, the pteropleura is bare, and the facial ridges are bare except near lower margin. Third wing vein bare at base, fourth not curved forward at apex. Belongs to the same group as *Phaonia* and its allies.

Genotype, the following species.

Phaomusca bakeri sp. nov.

Male.—Black, densely grayish dusted. Antennæ and palpi orange yellow, the latter infuscated basally. Thorax when seen from behind with four narrow dark brown vittæ; scutellum with a large brown mark centrally; humeri yellowish. Dorsum of abdomen deep black on disk of basal three visible tergites, merging into brown laterally, and not extending to sides; fourth tergite lead gray, slightly brownish at base, and narrowly rufous at apex. Legs rufous, fore coxæ, bases of hind femora, and the tarsi a little darker. Wings strongly tinged with yellow, veins yellow, darker apically. Calyptræ yellowish. Halteres brownish.

Eyes sparsely haired; frons linear above, orbits setulose on anterior half; parafacials in profile linear; cheek higher than width of third antennal segment, the latter about four times as long as second; arista plumose; palpi rather stout, their bristles short. Dorsocentrals 2 + 4; both postsutural intraalars long; prealar long; scutellum bare on sides and below; sternopleurals 1 + 2. Abdomen broadly ovate, basal sternite bare; all tergites with long sparse bristles on posterior margins and laterally at middle. Fore tibia without a median posterior bristle; mid femur with a few posteroventral bristles basally; mid tibia with three posterior bristles; hind femur with a series of short, fine, anteroventral bristles that become longer apically; hind tibia with two anterodorsal and three or four fine anteroventral bristles, the posterodorsal calcar short.

Length, 7.5 millimeters.

Type, Mount Banahao, Luzon (*Baker*).

Atherigona seticauda sp. nov.

Male.—Head black, orbits, frontal triangle, sides of occiput, and the entire face and cheeks densely gray dusted; interfrontalia dark brown, reddish in front; antennæ and palpi black; arista brown. Thorax black, densely gray dusted, dorsum with three rather faint dark vittæ; humeri slightly yellowish, obscured by the dusting. Abdomen testaceous yellow, sides of the rudimentary first tergite with a fuscous mark which extends over anterior part of second also, the second with a pair of large, subtriangular, dark, discal marks, third with a pair of large, oblong, fuscous marks on disk which extend almost the entire length of tergite, fourth with a pair of smaller brown marks, third and fourth tergites each with a pale brown central stripe, the dorsum with gray dusting between and laterad of the dark markings. Legs testaceous yellow, almost the entire fore femora, basal halves of mid and hind femora, apical two-thirds of fore tibiæ, and fore tarsi except the apical segment, black; hind tibiæ apically and hind tarsi basally darkened. Wings hyaline. Calyptræ and halteres whitish.

Head normal; second segment of arista about three times as long as thick, third tapered, microscopically pubescent; palpi long and rather slender, the basal bristles weak, apical hairs soft and curled. Thorax normal. Second and third abdominal tergites equally long, the third meeting on venter apically, fifth tergite with a pair of long slender divergent discal bristles which are as long as third tergite, and also with a slight transverse apical ridge in front of which the disk is slightly hollowed out, but there is no prominent chitinized protuberance; below the level of the base of hypopygial forceps there is a long bristle on each side similar to the one on fifth tergite, but the exact situation of these is impossible to decide except by dissection, a course not permissible with a single type that is distinguished by such outstanding structural characters as this one. Fore femur as in *varia* Meigen; fore tarsus as long as fore tibia, second segment with some erect hairs below, those at base longest and about as long as the segment; hind femur without preapical anteroventral bristle; hind tibia with a short, stout, sharp pointed apical bristle on posterior side. Inner cross vein a little beyond middle of discal cell; first posterior cell a little narrowed apically.

Length, 3.5 millimeters.

Type, Mount Maquiling, Laguna Province, Luzon (*Baker*).

No other species of the genus known to me has two pairs of long, backwardly directed bristles on the apical abdominal segments, and such a slight elevation of the fifth tergite.

Genus **XENOSINA** Malloch

I published a key to the species of this genus in 1925.[1] The new species described herein runs to *pudica* var. *rufomarginata* Malloch, but is much paler, with the presutural and anterior two pairs of postsutural dorsocentrals conspicuously shorter than the prescutellar pairs, not as long as those in *rufomarginata*, the apical bristles on third and fourth visible abdominal tergites are short and fine, whereas in the old species they are long and strong, and there is no transverse series of discal bristles on the fourth tergite in *siamensis*.

Xenosina siamensis sp. nov.

Female.—Head testaceous; frons black, with gray dusting; parafacials except at upper extremity, and the cheeks except at anterior margins, fuscous; occiput grayish, with a pale dusting; antennæ yellow; palpi brown. Thorax reddish testaceous, with grayish dusting, dorsum with four brownish vittæ. Abdomen reddish testaceous, shining. Legs concolorous with abdomen. Wings yellowish hyaline. Calyptræ and halteres concolorous with abdomen.

Head as in allied species. Only the two prescutellar pairs of dorsocentrals long and strong, the others (anterior intra-alar, and prealar) short and rather weak; scutellum bare on sides, one setula below near apex in type; hypopleura with a few microscopic hairs on lower posterior angle; some black setulose hairs along lower margin of metapleural spiracle which character is not found in any other species of the genus. Abdomen ovate, with some hairs on basal sternite which are normally absent in the genus, and no strong tergal bristles. Legs except the hind pair missing in type; hind femur with three or four preapical anteroventral bristles and one or two fine hairs near base on posteroventral surface; hind tibia with one anterodorsal and about four anteroventral bristles. Wing normal.

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[1] Philip. Journ. Sci. 26 (1925) 509.

Length, 7.5 millimeters.

Type, Biserat, Siam (*Robinson and Annandale*). [British Museum.]

MUSCINÆ

Genus **BRYANTINA** novum

Generic characters.—Apparently most closely related to *Graphomyia* Robineau-Desvoidy. Head higher than long, frons fully one-third of the head width in male, fully twice as wide as long at center, a little longer on sides, the orbits slightly differentiated, each with two bristles, the anterior one incurved, situated near front margin; ocellar, postvertical, and vertical bristles long, the postverticals widely divergent; face deeply excavated, with a slight central vertical carina; antennæ elongate, third segment covered with conspicuous pale down, and about eight times as long as second segment; second segment of arista much elongated, third widened in middle, long-haired on upper side from near base to apex, on underside only on apical fifth. Thorax with 2 + 4 dorsocentrals, one postsutural intraalar, one pair of prescutellar acrostichals, and a strong prealar; prosternum, propleura in center, pteropleura, hypopleura, and postalar declivity bare, fourth vein broadly curved forward beyond middle, the veins all bare. Abdomen robust. Legs slender. Lower calypter broad, subtransverse at apex.

Genotype, the following species.

Bryantina javensis sp. nov.

Male.—Head testaceous, upper occiput, frons, and face cinnamon brown, the vibrissal angles blackish; antennæ brown, third segment black, arista brown basally, black apically, the hairs black; palpi and proboscis testaceous, the latter dark at apex. Thorax testaceous, dorsum, including scutellum and postnotum, broadly black on disk, the mesonotum with lateral margins and two broad vittæ along lines of dorsocentrals white dusted, the white dust carried across in front of scutellum and connecting the submedian vittæ; a brown spot on middle of hind margin of mesopleura and another on sternopleura. Abdomen testaceous, with large transverse black marks on apical four visible tergites. Legs testaceous, tarsi black. Wings hyaline, costal vein yellow at base, dark beyond humeral cross vein, a dark patch near apex of submarginal cell and another near apex of first posterior cell due to the presence of dense, dark, microscopic hairs. Calyptræ yellow, a blackish spot on upper one near base. Halteres yellow.

Eyes sparsely hairy; second segment of arista fully six times as long as thick; cheek higher than width of third antennal segment; palpi tapered apically; proboscis slender, labellæ normal. Sternopleura with one fine bristle. First visible tergite occupying about one half the area of dorsum of abdomen, slightly concave in posterior outline, the next three tergites widest at middle, tapered laterally; basal two sternites with a conspicuous group of short black setulose hairs on each side of hind margin, the succeeding sternites less noticeably setulose, fifth with a shallow, broad, apical, rounded emargination; hypopygium small. Fore femur with a complete series of posteroventral bristles; fore tibia without a median posterior bristle; mid tibia with a short posterior bristle; hind femur without evident ventral bristles; hind tibia with one anterodorsal and anteroventral, both very short. Costal vein thickened beyond humeral break, tapered to auxiliary vein; third vein slightly arcuate apically.

Length, 5 millimeters.

Type, Tjibodas, Mount Gede, Java, 4,500 feet, 1909 (*Bryant and Palmer*).

Named in honor of the first-named collector. Type in United States National Museum.

The genus is one of the most remarkable of the genera in the subfamily; the strikingly distinct structure of the head and the absence of hairs on the base of arista are sufficient to distinguish it from any other in the male sex, which is the only one known to me at this time.

TACHINIDÆ

Genus **CYLINDROMYIELLA** novum

Generic characters.—This genus differs from *Cylindromyia* Meigen in having the palpi large and rather broad, and the first posterior cell of wing widely open, the venation being similar to that of many Phaoniinæ with the fourth vein very little forwardly inclined apically, not more than the third vein deflected apically. Despite the phaonine venation, this is a true tachinid, with much the same appearance as a *Cylindromyia.* Like that genus, it has the vertical part of thorax below base of abdomen and above hind coxæ heavily chitinized and slightly convex, its extent being about equal to that of metanotum below postscutellum. Vertex with a pair of strong inner bristles, the others minute or absent; ocellars small, divergent; frons in male about one-fourth of the head width, orbits narrower than interfrontalia, with only incurved inner marginal bristles; parafacials almost indistinguishable from the side; antennæ elongate; arista bare; proboscis short. Prosternum, and propleura centrally, bare; mesopleura with two or three bristles on upper third of hind margin; anterior sternopleural absent, the other two present; hypopleural bristles long. Abdomen subcylindrical, with bristles on sides of tergites, central apical bristles present only on first visible tergite. Inner cross vein a little before apex of first vein and slightly beyond middle of discal cell; outer cross vein at less than its own length from apex of fifth.

Genotype, the following species.

Cylindromyiella bakeri sp. nov.

Male.—Head blackish brown, densely gray dusted, antennæ dark brown, apex of second and base of third segment reddish; palpi dark brown. Thorax glossy black on disk, the sides of mesonotum, and the pleura gray dusted. Abdomen glossy honey yellow, becoming blackish apically. Legs shining brown. Wings grayish hyaline. Calyptræ white. Halteres yellow.

Eye facets enlarged slightly in front; cheek not as wide as the rather wide third antennal segment; palpi nearly bare. Dorsocentrals weak and short; presutural acrostichals weak, two-rowed; scutellum convex, with four bristles and many hairs. Tergites becoming shorter apically, the bristles on sides stout and of moderate length on first and second tergites, those on sides of third, and some of those on second short and rather stubby, one long bristle at base on each side of third. Hypopygium with a pair of short, sharp, slightly curved forceps. Femora rather stout, each with some sparse, moderately long bristles on basal half, and a series of short spines on apical half of anteroventral and posteroventral surfaces; fore and mid tibiæ without evident bristles at middle, hind tibia with one anteroventral, one posterodorsal, and two anterodorsal bristles, all short.

Length, 3.25 millimeters.

Type, Surigao, Surigao Province, Mindanao (*Baker*).

Genus **THRYPTODEXIA** novum

Generic characters.—A peculiar genus, with the habitus of a thryptocerine and the plumose arista of a dexiine. Frons at vertex about one-fifth of the head width, gradually widened to anterior margin, each orbit about as wide as interfrontalia, with four supraorbitals, the upper curved backward, second curved forward, third inward, and anterior pair curved forward, the three or four infraorbitals all curved inward; all four verticals long, postverticals short and weak; ocellars but little stronger than the postverticals; orbitals ceasing at base of antennæ; some short setulæ above each of the vibrissæ, the latter long; antennæ almost as long as the face, the latter shallowly concave, not carinate centrally; proboscis short and stout; palpi normal. Thoracic bristles moderately strong; sternopleurals 1 + 1; postscutellum well developed; type specimen pinned so that it is impossible to see the prosternum. Abdomen narrowly ovate, with apical bristles on tergites 2 to 4. Mid tibia with a median ventral bristle. First posterior cell ending in tip of wing, narrowly open, bend of fourth vein obtuse; inner cross vein close to middle of discal cell and a little proximad of apex of first vein; outer cross vein at about its own length from apex of fifth vein.

Genotype, the following species.

Thryptodexia polita sp. nov.

Female.—Glossy black, orbits and dorsum of thorax gray dusted. Antennæ and palpi luteous. Legs more brownish than body. Wings yellowish hyaline. Calyptræ whitish. Knobs of halteres fuscous.

Orbits and parafacials without hairs; longest hairs on arista as long as width of third antennal segment, length of latter over three times that of second segment. Presutural acrostichals, two pairs; postsutural dorsocentrals, four pairs. Fore tibia with a median posterior bristle; fore tarsus slender; femora sparsely bristled and rather stout.

Length, 4 millimeters.

Type, Los Baños, Laguna Province, Luzon (*Baker*).

Actia apicipunctata sp. nov.

Male.—Head testaceous, grayish yellow dusted, upper occiput fuscous; antennæ and palpi fuscous; palpi yellow. Thorax black, gray dusted, not vittate. Abdomen yellowish, semipellucid, apices of tergites, most of third and all of fourth fuscous, dorsum gray dusted. Legs testaceous yellow, bases of fore femora, apices of mid and hind pairs and of tarsi darkened. Wings hyaline, with a large fuscous spot extending from before apex of second vein to tip of wing and spreading over anterior half of tip of first posterior cell. Lower calypter brown on disk. Halteres yellow.

Frons normal; anterior orbital bristles extending below bases of antennæ; third antennal segment very large, as wide as widest part of eye; arista pubescent, second segment over four times as long as thick. Apical three tergites with marginal bristles. Legs normal. First wing vein setulose at apex above and below, third setulose at base below and on most of its length above; fifth bare; inner cross vein a little before middle of discal cell and apex of first vein; outer cross vein at about its own length from apex of fifth vein.

Length, 4.5 millimeters.

Type, Baguio, Benguet Subprovince, Luzon (*Baker*).

Genus **MALAYIA** novum

Generic characters.—Belongs to the group in Tachinidæ in which the first posterior cell is open and ends in the exact wing tip. Inner vertical bristles long, a pair of short incurved postverticals directly in line behind them, the outer verticals short; ocellars present, divergent; anterior supraorbital directed forward; the fine lateral hairs descending in a series along inner margin of parafacial to middle of latter, at which point they begin to parallel or intermingle with those on lower half of facial ridge; face in type slightly transversely elevated on upper half, but this may be due to distortion, as the specimen is slightly immature; arista bare, second segment about as long as thick; third antennal segment about three times as long as second, and with a series of short fine setulæ along its outer edge; proboscis short and stout; palpi apparently present in type, but it is impossible to distinguish them clearly. Prosternum bare; sternopleurals 1 + 1; hypopleurals fine; postscutellum small but distinct. Abdomen with apical bristles on tergites 1 to 4. Inner cross vein about one-third from apex of discal cell and distinctly beyond apex of first vein; bend of fourth vein about four-sevenths from outer cross vein to tip, from which point it runs diagonally forward to tip (fig. 1).

Genotype, the following species.

Malayia fuscinervis sp. nov.

Female.—Shining black. Interfrontalia brown, whitish dusted; antennæ black, reddish at base of third segment. Thorax gray dusted, most distinctly so on sides of mesonotum, and with two narrow black vittæ between dorsocentrals and acrostichals in front of suture. A rather conspicuous fascia of white dust at base of second tergite. Legs black. Wings grayish hyaline, marked with fuscous, as in fig. 1. Calyptræ white. Halteres black.

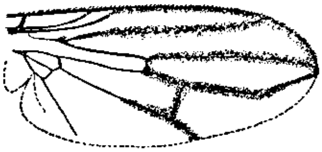

FIG. 1. *Malayia fuscinervis* sp. nov., wing.

Frons at vertex about one-third of the head width, slightly widened anteriorly, each orbit as wide as interfrontalia, upper supraorbital distinctly in front of anterior ocellus, curved outward and backward, anterior one curved forward and situated close to level of the upper incurved infraorbital; arista rather thick; third antennal segment about four times as long as wide and fully three times as long as second; eyes narrowed below; cheek about one-third of eye height. Thorax with 2 + 3 dorsocentrals, and only hairlike acrostichals. Fore tibia with two anterodorsal and two posterior bristles; mid tibia with an anteroventral, one anterodorsal, and one posterodorsal bristle; hind tibia with two anterodorsal, anteroventral, and posterodorsal bristles. Calyptræ rather small, rounded at apices, clear of scutellum at base.

Length, 4.75 millimeters.

Type, Pahang, Camerons Highlands, Federated Malay States, 4,800 feet, at light, October 18, 1923 (*Pendlebury*).

The outstanding feature of this genus is the setulose anterior (upper) margin of the third antennal segment; some other genera have this segment downy or pilose, but no other one known to me has it setulose, as here.

Tribe PALPOSTOMINI

Although the acceptance of tribes in this family is accompanied by many difficulties there are some which appear to be fairly well distinguished, and amongst these is the Palpostomini. The character of the palpiform apical labellæ of the proboscis is a rather uncertain one to depend on, but the narrow, apically rounded, lower calypter, almost bare arista, approximation of the apex of first posterior cell to the tip of wing, and the setulose prosternum, taken in combination, readily distinguish the genera from those of other tribes.

Ochromeigenia ormioides Townsend.

Apparently a common and widely distributed species. I have seen it from China, Sumatra, Java, and the Federated Malay States. I have no doubt that it occurs in the Philippines.

ILLUSTRATION

TEXT FIGURE

FIG. 1. *Malayia fuscinervis* sp. nov., wing.

PHILIPPINE CRICKET-LOCUSTS (GRYLLACRIDÆ)

By H. H. KARNY

Of Buitenzorg, Dutch East Indies

THREE PLATES

After having completed my paper on Philippine cricket-locusts (Gryllacridæ)[1] I received further material from Prof. C. F. Baker for determination. As was to be expected, the material contained several interesting specimens which are here presented.

VENATIONAL TYPE III (=IIIa)

Gryllacris plebeia Stål.

Gryllacris plebeia Stål, KARNY, Philip. Journ. Sci. 28 (1925) 136.

Gryllacris plebeia subsp. **immaculata** Griffini. Plate 2, fig. 2.

Gryllacris plebeia subsp. *immaculata* Griffini, KARNY, Philip. Journ. Sci. 28 (1925) 139.

One female from Mount Maquiling, Luzon (*Baker*); measurements intermediate between those of the female from Polillo and of that from Mount Maquiling. Tegminal venation practically as in Plate 10, fig. 2,[1] but the precostals very weak and indistinct; subcostal vein not simple, but simply forked before the end, the fork branches, however, much shorter than in fig. 3;[1] branches of R and Rs practically as in fig. 2,[1] but much less divergent; following veins all as in fig. 2.[1]

For shape of ovipositor see Plate 2, fig. 2.

Gryllacris isseli Griffini. Plate 3, fig. 1.

Gryllacris isseli GRIFFINI, Ann. Mus. Nat. Hung. 11 (1913) 299, 303; BRUNER, Univ. of Nebraska Stud. Lincoln No. 2, 15 (1915) 267; GRIFFINI, Philip. Journ. Sci. § 10 (1915) 65, 69.

Gryllacris nigrogeniculata tristis KARNY, Philip. Journ. Sci. 28 (1925) 148.

When describing my subsp. *tristis*, I had only one female before me, and I could not find any differences between it and the true *nigrogeniculata* other than color characters and a very slight difference in shape of ovipositor. Therefore, I believed it to be nothing but a mere color race of *nigrogeniculata*, and could not identify it with a different species. Now I have from Professor Baker a male from the same locality, which belongs without doubt to the same form as the *tristis* female. This male, however, differs from *nigrogeniculata*, not only in color characters, but also in the shape of the external genitalia (Plate 3, fig. 1); in fact, it differs so greatly that it must be regarded as a different species. On the other hand, it agrees fairly closely with *isseli* Griffini, the differences being only in individual characters. Therefore, *tristis* female must be placed with *isseli*, as it represents the hitherto unknown female of this Griffinian species.

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[1] Philip. Journ. Sci. 28 (1925) 131–171.

The venation of the male now before me is practically the same as in the female previously described;[2] the rich development of the medial vein, especially, agrees very well, on both tegmina, with that shown in fig. 2 (female).[2] The last and penultimate tergites, described by Griffini as "castaneum," are quite brownish black in the male before me. The genitalia also agree with Griffini's description, except that one of the two teeth of the ninth tergite is not obtected by the subgenital plate in the specimen before me; these teeth become castaneous distad. By comparing fig. 1 (Plate 3) given here with Plate 4, fig. 12,[2] of *nigrogeniculata*, it is evident that both are built according to the same type but show differences of specific value; the teeth of the ninth tergite, especially, are somewhat differently shaped in the two species, and the styles are shorter in *isseli*, more inserted outside, and directed outward.

Measurements of Gryllacris isseli Griffini.

Length.	Male. mm.
Body	25
Pronotum	6.4
Tegmina	20.4
Fore femora	8.6
Hind femora	15.6

The male before me is somewhat larger than Griffini's type specimen, and also a little larger than the female described as *tristis*.

One male from Samar, leg. *Baker*.

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[2] Philip. Journ. Sci. 28 (1925) 148, pl. 7, figs. 1 and 2.

VENATIONAL TYPE IIIb

Gryllacris cyanipes sp. nov. Plate 1, figs. 1 to 3.

A bright species. General color yellow-brown, with shining black markings.

Occiput strongly arched, brownish black, with a large yellow-brown H, the branches of which run forward against the fastigium, parallel with another one, and diverge backward strongly against the fore margin of the pronotum. From the upper angle of each eye runs a broad yellowish band above the antennal insertion mesad and forward, communicating with the anterior part of the H-branches; there is another, strongly impressed yellow band, from the upper angle of the eye against the hind margin of the head, along the sides of the occiput; close before the hind margin arises a rather perpendicular, but strongly S-curved, yellowish line, which runs on to the genæ. Fastigium of vertex nearly twice as broad as first antennal segment, blackish, blunt on either side, not keeled, and with a small, not well-defined, yellow ocellar spot, the color continued backward to the H-branches of occiput, forward into a short, oblique, mesad-directed, yellow-brown streak. Antennæ ferrugineous brown throughout, scrobes margined below and inside broadly black. Border between fastigia of vertex and of front broadly black. Frontal fastigium yellow-brown, with a very indistinct, small ocellar spot. Forehead shining, yellow-brown, depressed against the clypeus and becoming darker; on either side two impressed, circular, well-defined, black dots, arranged in a slightly oblique line which is about parallel to the lateral parts of frontoclypeal suture, and about as far from the latter as from another line. From the inner lower angle of scrobes runs an oblique black band mesad and downward, then suddenly obtusangularly curved downward and continuing perpendicularly to the inner, impressed dot. Subocular furrow strongly impressed, broadened downward, broadly black. Mouth parts of usual shape, dark castaneous, mandibles even darker along the inside. Palpi long, apical joints somewhat thickened distad, that of labial palpi obliquely truncate and distinctly excavate at apex, much less broadened than in the species of the *fumigata* and *fasciculata* groups. Genæ strongly arched, shining black, with the yellowish curved line coming from the occiput and broadly yellowish below and behind.

Pronotum longer than wide, with rounded fore and truncate hind margin, yellow-brown, broadly margined with black all around. Disk with a transverse furrow close behind fore margin, and another, strongly convex backward, before hind margin; both strongly impressed and broadly black. In the middle a rather narrow black band running throughout the whole length, and inclosing in its middle part a slight, short, longitudinal sulcus. Laterad from the fore end of this furrow is a large, slightly impressed, black spot from which issues forward a short black streak; backward and outward, apposed to it, is the fore angle of a large, oblique, black triangle, the rear angle of which reaches the hind sulcus, and the lower angle is situated at the communication of the hind branch of the V-sulcus with the oblique hind sulcus of the lateral lobes. These furrows are both strongly impressed, broadly black, the spaces between them and against the margins strongly arched. The black color of the V-sulcus is connected at its lower angle with the black of the margin, that of the oblique hind sulcus is also continued into the marginal black; above it is a second black band at the sides of the discal metazona, running from the large black triangle to the lateral angle of the truncate hind margin of the disk. Altogether, we have here a pronotal picture of the *signifera* type, but more melanistic; that is, the black markings are more expanded and are partly confluent with one another.

Organs of flight (Plate 1, figs. 1 and 2) distinctly reaching beyond the hind knees, but not or hardly the end of the abdomen. Venation according to type IIIb; that is, of the same type as in the Bornean *venosa*.[3] Tegmina whitish hyaline, with extraordinarily thick black longitudinal and cross veins; only the costal vein brownish yellow, but when approaching the fore margin gradually becoming darker, at least black too. Two precostals; at the end of the second one the fore margin is strongly excavated. Costa straight, at the excavation approximating close to the fore margin and reaching it then about in its middle. None of the tegminal fields unusually broadened, all of about the same width. Subcosta bifurcate close before the end, reaching the fore margin about at the beginning of the apical third. Radial sector originating from radial vein about in the middle of tegmen, furcated into three branches, the two apical ones extraordinarily short; radial vein itself bifurcate close before the end. Medial and cubital veins with a rather long, common stem which furcates into these two chief veins about at the end of basal fourth of tegminal length. Medial vein itself again bifurcate on the left tegmen in the specimen before me, about in the middle of tegminal length, but the branches of the fork unite again, still before reaching the apical margin, while the medial vein of right tegmen remains simple throughout. Cubital vein remaining simple on both tegmina. Behind the common stem of medial and cubital veins a distinctly impressed anal fold is visible, indicating with certainty that the stem is indeed M + Cu and not M alone. Behind it five simple longitudinal veins, the last two with a very short, common stem.

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[3] Journ. F. M. S. Mus. 13 (1925) 25–27, fig. 11.

Hind wings grayish hyaline. Costa and subcosta and the cross veins between them brownish yellow, all other veins strong, blackish, but not as broadly black as in tegmina. Preanal field very narrow, as in *venosa*. Costal marginal. Subcostal vein running in a forward concave bow to the fore margin, which it reaches about in the middle. Following veins arranged according to the same type as in *venosa;* in the figure in my paper cited above,[3] the names of the veins must now be corrected from those given in my earlier paper.[4] The vein indicated in the Journal of the Federated Malay States Museum, fig. 11, as Rs, will be in fact Rs + M; M should be changed to Cu, and Cu will represent CuS. A definite decision on this point will be impossible, however, before the larval wing cases of the *venosa* type have been studied—a study which it will not be possible to make in the near future because of the extraordinary rarity of specimens belonging to this type. Radial vein simply forked before apex, reaching the fore margin about at the beginning of its apical fourth. This vein sends forth, close before the middle, a short oblique cross vein (probably base of Rs + M, as I have indicated in Plate 1, fig. 2) which communicates with the longitudinal vein behind it (probably Cu) for a very short distance (much shorter than in *venosa*); then, after leaving that longitudinal vein, again simply forked distad (probably into Rs and M). The following two longitudinal veins (probably Cu and CuS) with a short common stem, simple throughout. Anal fan large, anal veins numerous.

Legs very stout, comparatively short. Coxæ yellow-brown, marked with shining black, fore coxæ shining black nearly throughout. All femora and tibiæ shining black throughout, with a bright steel blue splendor. Fore and middle tibiæ with four pairs of moderately long, movable spines of the same black color as the tibiæ, but becoming yellowish at the tips. Hind

[4] Zeitschr. wiss Zool. 25 (1925) 35–54.

femora very thick, with five to eight strong spines outside, twelve inside. Hind tibiæ unarmed below (except the apical spurs); above complanate and armed with four or five strong spines outside, three or four inside, except the apical spines. All tarsi pale brownish yellow throughout, claws black.

Abdomen brownish yellow above and laterad, blackish below. Cerci yellow-brown, about one-third the length of the ovipositor. Subgenital plate (Plate 1, fig. 3) triangular, angulately excised at apex. Ovipositor moderately upcurved, gradually tapering to the tip, which is rather acute.

Measurements of Gryllacris cyanipes sp. nov.

Length.	Female. mm.
Body	36.3
Pronotum	9.0
Tegmina	27.0
Fore femora	9.7
Hind femora	17.5
Ovipositor	17.0

One female from Samar (*Baker*).

This new species is without doubt closely related with the Bornean *venosa,* the only species hitherto known to represent the same type of venation. *Gryllacris cyanipes* differs, however, from *venosa* by the shining black markings of head and pronotum, by the different shape of the female subgenital plate, and especially by the bright steel blue femora and tibiæ of all legs, which contrast strongly with the pale, yellowish tarsi.

Griffini[5] compared with *venosa* the following species: *primi-genii* from Luzon, *la-baumei* from Lombok, *grassii* from Borneo, and *martha* from Annam. I have had occasion to study only *grassii,* and found it to differ widely from *venosa* and *cyanipes,* its venation being according to type II.[6] Of the three others, it is not possible to say whether they agree in venation with *grassii* or with *venosa* and *cyanipes.* If any conclusion can be drawn from the length of the hind femora, it should be expected that *primi-genii* and *martha* are more closely related with *grassii,* while the length of the tegmina would place *martha* also much nearer to *grassii* than to *venosa* and *cyanipes.* On the other hand, *la-baumei* should perhaps be placed nearer to *venosa* and *cyanipes,* if it is not related with the *horváthi* and *personata* groups and thus representing type IV. These points cannot be definitely determined until the venation of all these species shall have been studied. At all events, *cyanipes* differs from all of these species at first view by the very distinctive color of the legs.

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[5] Mon. Zool. It. 29 (1918) 28.

[6] Treubia 5, Livr. 1–3 (1924) 68, fig. 27.

VENATIONAL TYPE V

Gryllacris recticauda Karny.

Gryllacris recticauda KARNY, Philip. Journ. Sci. 28 (1925) 152.

Gryllacris recticauda subsp. **ochropis** subsp. nov. Plate 2, figs. 1 and 4; Plate 3, fig. 5.

Very near in size and appearance to the typical form, but the general color somewhat paler, more yellow-brown. Head quite pale, concolorous, except the black eyes, and the labrum which is yellowish in the middle, broadly blackish brown laterad and below. Ocellar spots small, yellow, indistinct. First antennal segment infuscated at apex, second basad and distad, others concolorous, ferrugineous.

Pronotum as in typical *recticauda*. Tegmina also practically as in that form, the venation, however, somewhat different, but this may perhaps be a mere individual variation (Plate 3, fig. 5). Costal area somewhat wider. Radial sector on left tegmen simple, arising from radial vein more basad, close behind the middle of the tegminal length, therefore before the first fore branch of the radial vein; on right tegmen practically as in typical *recticauda*,[7] but the apex of the radial vein, after emitting the sector, simple, not forked again. Medial vein on both tegmina coalescent with cubitus at the very base only, thus practically free, further simple, not forked as in the typical form. Cubital vein distinctly furcate before the middle on both tegmina. Following veins as in typical *recticauda*, but the last anal more abortive, on left tegmen (Plate 3, fig. 5) even more than on right. Hind wings practically as in the typical form.

Legs pale, testaceous, only the base of tibiæ black, on fore and middle legs for about 1.5 millimeters, on hind legs for 2½ millimeters; apex of hind femora somewhat infuscated. Spines of all legs as in the typical form, those on hind tibiæ black throughout and with a black spot apposed at their bases.

Ovipositor (Plate 2, fig. 1) as in typical *recticauda*, quite straight. Subgenital plate of female flattened, acuminate at apex, before it a short longitudinal keel and at the base of this a small, but deep, circular impression.

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[7] Philip. Journ. Sci. 28 (1925), pl. 2, fig. 5.

Measurements of Gryllacris recticauda subsp. ochropis subsp. nov.

Length.	Female. mm.
Body	21.8
Pronotum	4.7
Tegmina	14.3
Fore femora	7.7
Hind femora	14.5
Ovipositor	14.5

One female from Mount Maquiling, Luzon (*Baker*).

There is no doubt that we have here a form supplying quite the same type in Luzon as that represented in Mindanao by typical *recticauda*. The question is only whether *ochropis* should be considered a mere local race or a separate species. The general appearance is very near to typical *recticauda* and the differences consist in mere color characters; on the other hand, the shape of the subgenital plate of the female is so different that it should be perhaps expected that the males, when they become known, will also show valuable differences in the shape of the external genitalia. Then it would perhaps become necessary to consider *recticauda* and *ochropis* as different species, but this question cannot be definitely decided until further material (especially males) of both can be studied. It is a very regrettable fact that nearly all the species and subspecies of *Gryllacris* are represented in Professor Baker's collection by one specimen only, so that it is practically impossible to give entirely satisfactory descriptions; therefore, many important systematic problems must remain undecided for the present.

Gryllacris recticauda subsp. **ochrocnemis** subsp. nov. Plate 1, figs. 4 and 5; Plate 3, fig. 3.

Very similar to typical *recticauda*, but somewhat larger and paler. Color of head much as in the typical form. The pronotum, too, offers no usable difference.

Tegmina larger and especially broader than in typical *recticauda*, the venation, however, according to the same type (Plate 1, figs. 4 and 5). Radial sector arising from radial vein on right tegmen before the middle three-branched, while the radial vein itself is simply forked; on left tegmen radial sector and radial vein grown together throughout, this R + Rs being five-branched, forward pectinate. Medial and cubital veins with a short but distinct common stem, the former simple on right tegmen, furcate before the middle on left tegmen, the latter simple on both. Following veins practically as in typical *recticauda,* as is also the case with the venation of the hind wings.

Legs pale throughout, brownish yellow, only the hind femora slightly infuscated at the very extreme tip. Spines as in the typical form, seven to nine on the hind femora outside. Left hind tibia with six spines outside, seven inside, right with seven outside, six inside. All spines of hind legs pale basad, blackish at their tips.

Apical tergite of male (Plate 3, fig. 3) enlarged, with a broad, shallow longitudinal furrow; produced at apex in two very small, acute, straight, crossed spines, which are black at the tips. Subgenital plate strongly transverse, very short; apical margin emarginate with broadly rounded lobes. Styles lateral, very short and thick.

Measurements of Gryllacris recticauda subsp. ochrocnemis subsp. nov.

Length.	Male. mm.
Body	21.0
Pronotum	5.6
Tegmina	17.5
Fore femora	7.6
Hind femora	14.7

One male from Samar (*Baker*).

Thus, *ochrocnemis* represents the *recticauda* type on Samar; it is distinguished from both *ochropis* and typical *recticauda* by the rather pale tibiæ, from *ochropis* by the color of forehead which is the same as in typical *recticauda.* As with the preceding form, nothing can be stated with regard to the systematic rank until males of *recticauda* and *ochropis* and females of *ochrocnemis* are known. The great similarity between *ochrocnemis* and *recticauda* would suggest that the male sexual organs of the latter will be found to be shaped according to the same type as in *ochrocnemis,* but no definite statement can be made on this point until the males of *recticauda* have been studied.

Gryllacris patellaris sp. nov. Plate 2, figs. 3 and 5; Plate 3, fig. 4.

A small species. General color ferrugineous. Antennæ ferrugineous yollow, first to third joints infuscated basad. Eyes dark, ovate, about twice as high as long. Fastigium of vertex somewhat narrower than first antennal joint, sharply keeled laterad. Both fastigia, margins of antennal scrobes, and the entire front dark brownish black. Ocellar spots very indistinct. Forehead much wider than high, smooth, with some very small, pin-pricklike dots, and under the magnifying glass very finely and densely rugulose. The blackish color of the forehead becomes gradually paler laterad, quite vanishing at the subocular sulcus; this distinct in its lower part (above the base of mandibles), shallow, triangular. Genæ brownish yellow. Clypeus dark above, gradually becoming pale yellow below. Labrum blackish. Mandibles ferrugineous. Palpi long and slender, the maxillary ones longer than the head is high, labial palpi hardly half as long. Apical joints somewhat thickened distad, those of the labial palpi much stronger than the maxillary ones; the former very obliquely truncate at apex, the latter transversely, both with strongly excavate apical area.

Pronotum brown, unicolorous; sculpture of disk very shallow, almost indistinct, while the V-shaped and the oblique hind sulci of the lateral lobes are strongly impressed, the areas between them strongly arched. Fore margin of disk roundly produced in the middle, hind margin roundly truncate. Lateral lobes trapezoidal, with rounded angles. No humeral sinus. Posthumeral tooth short and thick, directed horizontally backward.

Organs of flight shortened, hardly reaching beyond the hind knees and the apex of abdomen. Tegmina (Plate 3, fig. 4) ocherous, becoming paler and slightly more hyaline toward the tip, with somewhat darker ferrugineous veins. Three precostals. Costal vein slightly curved, forward convex, simple, reaching the fore margin distad from the middle. Costal area somewhat enlarged. Subcosta curvate, convex backward, simply forked close before the end, reaching the fore margin closely distad from the costal vein. Radial vein practically straight throughout, without a separate sector, diverging in the apical part into three (left tegmen) or four (right tegmen) branches, all of which reach the fore margin even before the apex. Medial vein free from base, nearly straight, touching the radial vein at one point about in the middle (left tegmen) or communicating with it for some distance distad from the middle (right tegmen), thus becoming by this communication actually a Rs + M, which is simply forked on right tegmen, and four-branched (backward pectinate) on left tegmen. Cubital vein exceedingly developed on both tegmina, forked before the middle, the fore branch then forked again about in the middle of the tegmen, the hind branch remaining simple. Following veins simple, four in all, first and second distinctly S-curved. Hind wing cycloid, grayish hyaline, with dark ferrugineous veins. The poor condition of the specimen does not permit description of the venation.

Legs stout, brownish yellow, all tibiæ paler than the femora, but blackish at the extreme base for about 1 millimeter on fore and middle legs, for 1.5 millimeters on hind legs. Femora not darkened at the tips. Fore and middle tibiæ with the usual four pairs of movable spines which are as long as or hardly longer than the tibia is broad, gradually becoming shorter distad. Hind femora very thick, with five to eight dark brown spinules outside, ten to twelve smaller ones inside. Hind tibiæ on each margin with six blackish spines and with a comparatively large shining black spot at the base of every spine. Tarsi pale, yellowish, claws black at tips only.

Ovipositor (Plate 2, fig. 3) strongly upcurved, short, broadest near base, gradually tapering to middle, from here to close before tip remaining nearly equally wide, at the tip somewhat obliquely truncate above. Subgenital plate of female rounded trapezoidal, with a large, ovate, transverse pit showing two small longitudinal lines (keels?) in its middle. At the border between subgenital plate and the preceding sternite, there is visible a small circular pit in the middle.

Measurements of Gryllacris patellaris sp. nov.

Length.	Female. mm.
Body	17.2
Pronotum	4.2
Tegmina	12.8
Fore femora	5.0
Hind femora	10.0
Ovipositor	8.0

One female from Mount Banahao (*Baker*).

In its small size the present insect somewhat resembles the species of the *punctifrons* group,[8] but differs from all of these at once by the color of the forehead. In this character, it agrees with *infumata*, a species I know from Brunner's description only. As Brunner says nothing about the shape of the fastigium or of the tegminal venation, I cannot decide whether the species are really related or not. At all events, *patellaris* differs from *infumata* by the much shorter ovipositor and by the different shape of the female subgenital plate. The dark forehead also somewhat resembles that of *recticauda;* but no large, yellow, lower ocellar spot is present in *patellaris* as there is in *recticauda;* further, the insect is smaller, the venation different, and the shape of the ovipositor quite different. By the same characters, *patellaris* may be distinguished also from *plebeia,* in which it would belong according to Griffini's key.[9]

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[8] Philip. Journ. Sci. 28 (1925) 154.

The arrangement of tegminal veins in the specimen before me is very curious and differs from all hitherto known *Gryllacris* venation. It may, however, be placed with type V, but cannot be identified with either Va, Vb, or Vc (= *Larnaca* type).[10] If the present specimen showed no abnormality (but the veins are arranged according to the same type on both tegmina!), it should be distinguished as a distinct subtype (Vd), characterized by the strongly developed cubital vein and, especially, by the basad free media communicating with the radial vein and then running farther as Rs + M, therefore without a separate radial sector. This coalition of Rs with M recalls somewhat type II,[11] of *plebeia connexa*[12] and of *chopardi;*[13] but in all these cases the base of the radial sector is developed as a distinct, oblique cross vein connecting the radial vein with the media, whereas in *patellaris* the latter vein communicates with the radius, not leaving even the extreme base of the radial sector free. Further material of this remarkable species is needed to show if this curious venational type is constant in this species.

Gryllacris longispina sp. nov. Plate 2, figs. 6 and 7; Plate 3, fig. 2.

A rather small species. Ferrugineous yellow, practically unicolorous. Head oblong, when seen in front. Eyes ovate, shining black. Fastigium of vertex somewhat wider than the first antennal joint, very bluntly keeled laterad, nearly rounded, about as in *recticauda.* Ocellar spots rather indistinct. Forehead smooth, set with a few long hairs, depressed below. Subocular sulcus distinct though shallow, slightly S-curved. Mouth parts concolorous, labrum only somewhat darkened. Pronotum rufous brown, somewhat nebulose; shape and sculpture practically as in the preceding species.

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[9] Philip. Journ. Sci. § D 10 (1915) 63–65.

[10] See Journ. F. M. S. Mus. 13 (1925) 45 ff.

[11] Treubia 5, Livr. 1–3 (1924) 61.

[12] Philip. Journ. Sci. 28 (1925) 141.

[13] Treubia 9, Beitr. 16 (1926).

Organs of flight reaching a little beyond the end of the abdomen, touching the hind knees. Tegmina (Plate 2, figs. 6 and 7) ferrugineous yellow, gradually becoming somewhat grayish hyaline before the tip. Veins ferrugineous yellow, arranged according to type Va. Two or three precostals. Costal vein simple, curved, forward convex, reaching the fore margin distad from the middle. Costal field broadened near its middle, tapering distad. Subcostal vein curved, backward convex, simple, reaching the fore margin at the beginning of the apical third. Radial vein curved forward, simple on right, simply forked on left tegmen. Radial sector arising from radial vein in the middle on left, distad from it on right tegmen, simply forked. Basad from radial sector there originates from radial vein the media, which is simply forked about in the middle of tegmen (left tegmen), or three-branched (on right tegmen). Cubital vein simple on both tegmina. All these chief veins show a certain tendency to obtusangulate deviations, thus forming some irregularly polygonous cells, especially in the distal part of tegmina. Behind the cubital vein there follow four simple longitudinal veins, the last two of which originate from a very short common stem.

Hind wings cycloid, hyaline, with yellowish longitudinal and dark brown cross veins. Costa marginal. Subcostal vein simple, curved forward, reaching the fore margin about in its middle. Radial vein practically straight, ending about at the tip of the wing, emitting two oblique cross branches against the fore margin. Cubital stem communicating with radius in basal part; from there originates a common stem (Rs + M + Cu), which emits after a short distance a simple longitudinal vein (Cu); then about in the middle of wing length a second one (M), at last bifurcate before the end (Rs), these forked branches about half as long as their stem.

Legs moderately long and rather stout, unicolorous. The movable spines (four pairs) on fore and middle tibiæ unusually long, the second somewhat more than twice as long as the tibia is wide, then decreasing in length distad.[14] Hind femora, too, of a similar shape as in that species,[15] with eight rather short spines outside, eleven or twelve inside. Spines of hind tibia unusually long, almost as long as the tibia is broad, directed obliquely backward, seven on each side. All spines of hind legs with blackish tips.

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[14] *Gryllacris arctatiformis*, Philip. Journ. Sci. 28 (1925) pl. 4, fig. 5.

[15] Op. cit., fig. 1.

End of male abdomen (Plate 3, fig. 2) concolorous. Eighth tergite enlarged, produced backward. Apical tergite perpendicular, with a median length sulcus and an evenly rounded general outline, but at the tip produced into two long spinelike processes, which are crossed and strongly produced horizontally laterad. Cerci rather short. Subgenital plate transverse, with reduced, nodiform styles.

Measurements of Gryllacris longispina sp. nov.

Length.	Male. mm.
Body	18.5
Pronotum	4.9
Tegmina	15.0
Fore femora	7.4
Hind femora	14.1

One male from Samar (*Baker*).

The new species in many respects resembles *plebeia immaculata*, with which it would be placed, according to Griffini's table (1915). It differs, however, by its tegminal venation and by the shape of the apical tergite, which are quite different. The former agrees with type Va, and no species of this type are yet known from the Philippine Islands. By this it recalls the Javanese *pallidula*, from which it differs, however, by the other characters, especially by the pale fastigia and by the apical tergite spines, which are much longer and stronger than in the Javanese species. The shape and armature of the legs recall *arctatiformis*, but the tegmina are much longer in the latter and represent a quite different venational type. Finally, there seems to be much resemblance to *solitaria*, but the male sexual characters show great differences, as described by Griffini (1918).

VENATIONAL TYPE IV

Gryllacris maculipennis bakeri Griffini.

Gryllacris maculipennis bakeri GRIFFINI, Atti Soc. It. Sci. Nat. 48 (1909) 81 (*maculipennis* var.); Rev. Suisse Zool. (1909) 390 (*maculipennis* var.); Atti Soc. It. Sci. Nat. 49 (1910) 14 (*maculipennis* var.); Philip. Journ. Sci. § D 10 (1915) 63, 67; Mon. Zool. It. 29 (1918) 23.

One female from Samar (*Baker*) agrees very well with Griffini's description (also in the shape and length of the ovipositor), but has the disk of the pronotum infuscated, especially along the fore and hind margins and along the sulci; lower part of lateral lobes pale yellowish. All femora have the outer lower carina blackish; the long movable spines of fore and middle tibiæ also grayish black, except at the tips, which are pale yellowish.

Gryllacris nasalis detersa Griffini.

Gryllacris nasalis detersa Griffini, KARNY, Philip. Journ. Sci. 28 (1925) 164.

One male from Los Baños (*Baker*) quite agrees with Griffini's description, but is conspicuously smaller.

Measurements of Gryllacris nasalis detersa Griffini.

Length.	Male. mm.
Body	25.0
Pronotum	5.8
Tegmina	25.0
Fore femora	8.4
Hind femora	14.7

The blackish labrum and the curious shape of the male apical tergite, described by Griffini in 1913, are very distinctive.

ILLUSTRATIONS

PLATE 1

FIGS. 1 to 3. *Gryllacris cyanipes* sp. nov., female; *1*, tegmen; *2*, fore part of hind wing; *3*, subgenital plate.

4 and 5. *Gryllacris recticauda ochrocnemis* subsp. nov., male; *4*, left tegmen; *5*, right tegmen.

PLATE 2

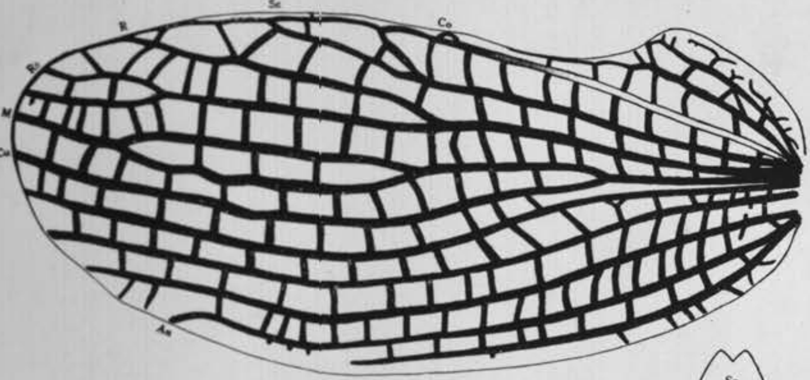
FIG. 1. *Gryllacris recticauda ochropis* subsp. nov., ovipositor, lateral view.

2. *Gryllacris plebeia immaculata* Griffini, ovipositor, lateral view.
3. *Gryllacris patellaris* sp. nov., ovipositor, lateral view.
4. *Gryllacris recticauda ochropis* subsp. nov., female, subgenital plate, ventral view.
5. *Gryllacris patellaris* sp. nov., female, subgenital plate, ventral view.
6. *Gryllacris longispina* sp. nov., male, venation of left tegmen.
7. *Gryllacris longispina* sp. nov., male, venation of right tegmen.

PLATE 3

FIG. 1. *Gryllacris isseli* Griffini, male, end of abdomen, ventral view.

2. *Gryllacris longispina* sp. nov., male, last tergite seen from behind.
3. *Gryllacris recticauda ochrocnemis* subsp. nov., male, end of abdomen, ventral view.
4. *Gryllacris patellaris* sp. nov., female, venation of right tegmen.
5. *Gryllacris recticauda ochropis* subsp. nov., female, venation of tegmen.



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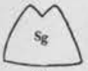

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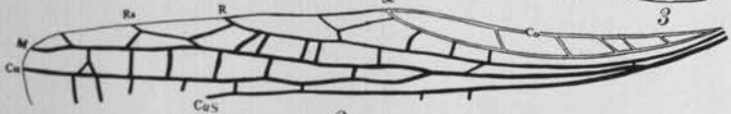

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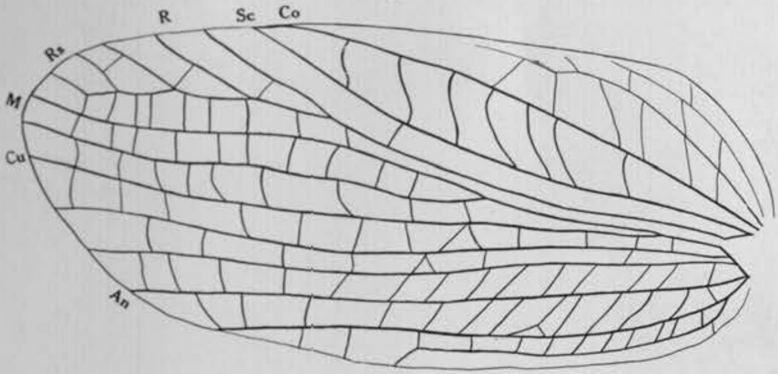

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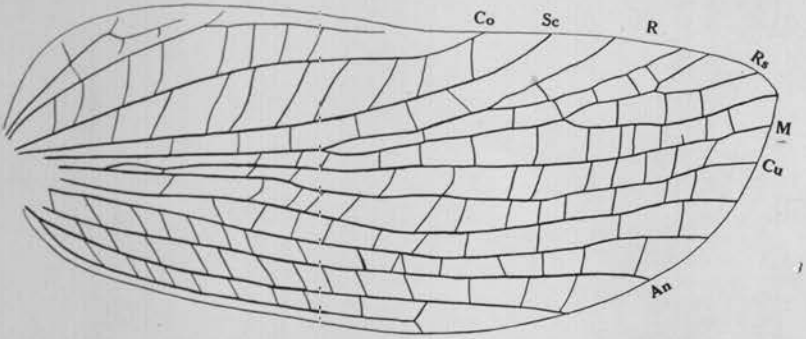

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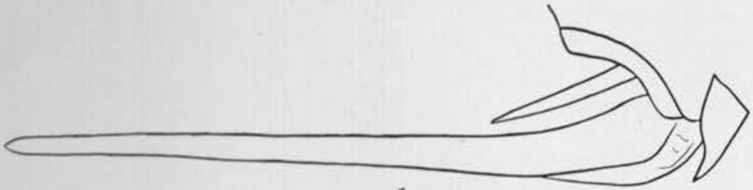
PLATE 1.



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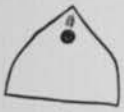

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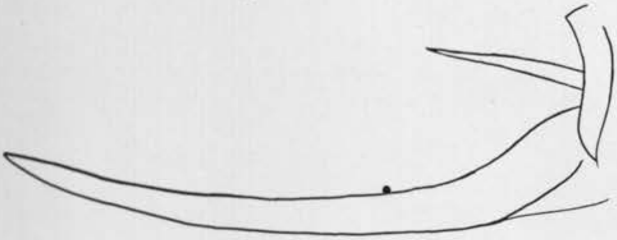

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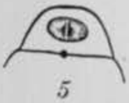

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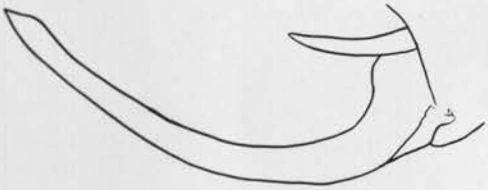

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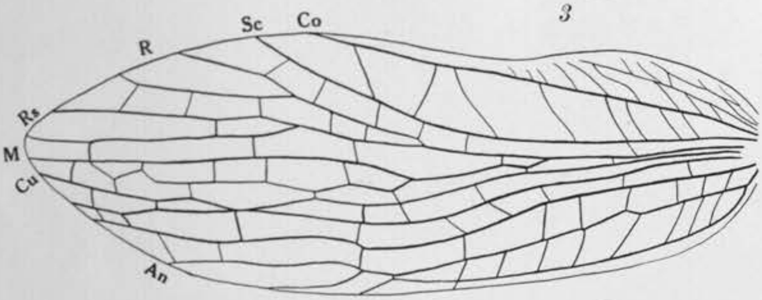

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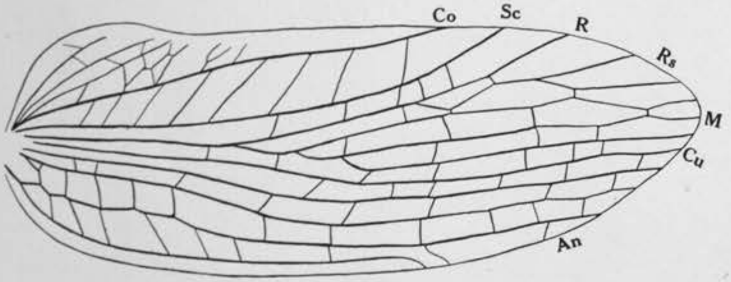

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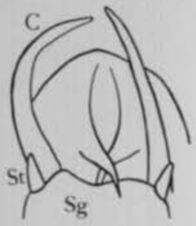
PLATE 2.



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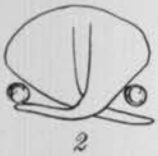

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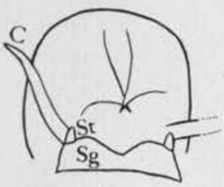

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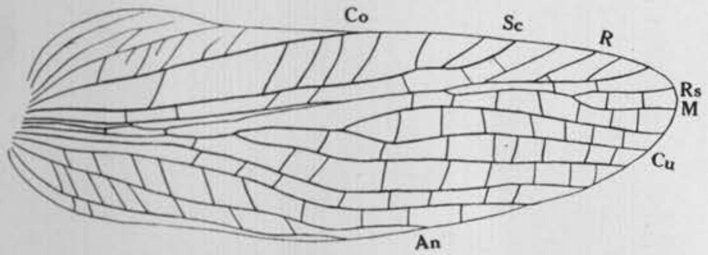

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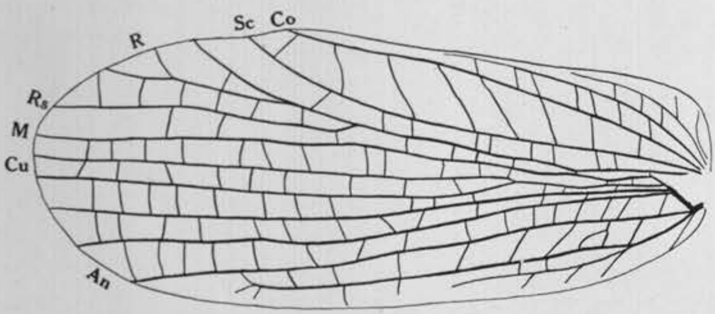

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PLATE 3.

FOUR NEW PHILIPPINE FISHES

By Albert W. Herre

Chief, Division of Fisheries, Bureau of Science, Manila

THREE PLATES

The family Balistidæ contains about fifty species of tropical reef and shore fishes, many of which attain a rather large size. They are of particular interest because some of them are dangerous to use as food, their flesh being more or less poisonous. I have given a detailed account of the Philippine balistids, or trigger fishes, in an earlier paper.[1] To the genera and species there described I am now able to add a new species belonging to a genus not previously known from the Philippines.

Key to the Philippine genera of Balistidæ.

- a^1. Teeth white.
  - b^1. Teeth uneven, oblique, more or less deeply notched.
    - c^1. Caudal peduncle flattened dorsoventrally .... **Abalistes.**
    - c^2. Caudal peduncle flattened laterally.
      - d^1. A groove in front of eye.
        - e^1. Several enlarged bony plates behind gill openings .... **Balistes.**
        - e^2. Gill openings surrounded by ordinary scales .... **Canthidermis.**
      - d^2. No groove before eye .... **Balistapus.**
  - b^2. Teeth even, resembling incisors .... **Melichthys.**
- a^2. Teeth orange or red .... **Odonus.**

Genus CANTHIDERMIS Swainson

Canthidermis Swainson, Nat. Hist. 2 (1839) 325.

This genus resembles *Balistes* in scalation except that there are no bony plates or enlarged scutes behind the gill openings; the thick rough scales do not overlap and may be comparatively smooth, or there may be several to many rows each with a spine or keel, especially on the caudal peduncle, which is laterally compressed like the body; the body is more elongate than in *Balistes;* the cheeks are completely scaled, with a deep, rather short groove before each eye; dorsal spines three, fitting closely into a deep groove when depressed, the first one very large;

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[1] Philip. Journ. Sci. 25 (1924) 422–449.

the soft dorsal and anal much elevated anteriorly; the pelvic flap comparatively small, with a blunt, immovable spine.

Species few; intertropical, south to the Cape of Good Hope, north to Japan.

Canthidermis viola sp. nov.

Dorsal III–III–23; anal III–20; there are 42 scales from the upper angle of the gill opening to the end of the vertebral column, with 3 or 4 more scales extending upon the caudal fin, and 29 scales in a transverse series from the origin of the second dorsal to the vent.

The elongate body much compressed laterally, its depth 2.96 times in the length; the head elongate, the dorsal and ventral profiles about equally convex, wider than the body, 3.4 times in the length; the snout 1.65 times in the head; the eyes circular, high up, 4.7 times in the head, 2.85 times in the snout; the interorbital space angulate, keeled, 1.85 times the eye and a little more than 2.5 times in the head; the gill slits little inclined, nearly an eye diameter behind the eye, the upper end below the level of the lower margin of the eye; the scales all have a central granular patch, and most of them on the sides are keeled; the scales between the soft dorsal and anal much larger than elsewhere, those before the first dorsal and about the eyes smallest, the head scaled to the lips; the first dorsal spine rough granular, 1.95 times in the head; when depressed into its groove it is flush with the body; the anterior portion of the second dorsal and anal greatly elevated, falcate, the longest dorsal rays 3.16 times, the anal 3.3 times in the length; the depth of the caudal peduncle 2.5 times in the head; the caudal bilobate, the lower lobe longest, a trifle more than the head; the pectoral 2.16 times in the head, placed just below and behind the gill opening; the ventral spine broad, immovable.

The color in life was uniform brownish violet, the top of the head and the snout brown, the fins all brown. The color in alcohol is little changed, the violet less evident.

Here described from the type, caught with hook and line at Manukan, one of the Cagayan Islands in the Sulu Sea, September 22, 1925. It is about 320 millimeters long.

This species has proved to be common on rocky reefs in the Visayas, large numbers having been caught recently by Japanese fishermen using the Muro Ami method. I have three fine specimens, 350 to 380 millimeters in length, taken at Bennett Island, off the coast of Masbate. Fish of this species were caught by the boatload off the coasts of Tablas and Marinduque. They are rarely eaten and the Japanese fishermen make no attempt to sell them, but throw them away.

BRANCHIOSTEGIDÆ

The body elongate or laterally compressed, the head subconical, its dorsal profile usually convex, often strongly so; there is no bony suborbital stay, the cranial bones are not cavernous, and the opercular bones are usually unarmed; the mouth terminal, oblique, with strong teeth, none on vomer or palatines; the premaxillaries protractile, usually with a blunt posterior canine, much as in the Labridæ; maxillary without supplemental bone, not slipping under edge of preorbital; scales small, ctenoid; a lateral line present, usually following the dorsal outline; dorsal fin long, relatively low, continuous, the spinous part much less developed than the soft portion; anal fin very long, spines few, feeble; ventrals thoracic, I–5, close together; gills 4, with a long slit behind the fourth; pseudobranchiæ well developed; gill membranes separate or more or less united; lower pharyngeals separate; pterygials long, hourglass-shaped, resting on both coracoids; pyloric cæca few or none; vertebræ 24 to 30.

Fishes of temperate and tropical seas, some of them large and excellent food fishes.

Genus **BRANCHIOSTEGUS** Rafinesque

Branchiostegus RAFINESQUE, An. Nat. (1815) 86.
Latilus CUVIER and VALENCIENNES, Hist. Nat. Poiss. 5 (1830) 277.

The elongate, laterally compressed body covered with moderate to small, silvery, finely ctenoid scales; the mouth oblique, rather large, the jaws about equal, with rather strong teeth in the outer row, the inner teeth small, the posterior canine small; the posterior edge of the preopercle finely serrate, the opercle entire; the lips without appendages, and there is no adipose appendage on the nape; six branchiostegals; air bladder simple; pyloric cæca few.

Species few, mostly in the East Indies, north to Japan.

Branchiostegus vittatus sp. nov.

Dorsal VII–15; anal II–11; lateral line 68 to 72; scales in transverse series opposite origin of anal, about 22.

The head and body strongly compressed laterally, the body elongate, tapering, its depth 3.75 to 4 times in the length; the large, deep, boldly convex head 3.48 to 3.63 times in the length, its depth almost equal to that of the body; the snout very steeply inclined, 2.64 to 2.76 times in the head; the large eyes 3.5 to 3.65 times in the head; the interorbital a little less than an eye diameter; the nape produced into a low keel; the mouth large, oblique, very low, the jaws subequal, the posterior angle of the maxillary beneath the pupil of the eye; the upper jaw has an outer row of strong sharp teeth and two inner rows of very small sharp teeth, with four short inner rows at the symphysis; the last tooth of the outer row is a small, hooked, forward-pointed canine; the lower jaw has an outer row of strong teeth as in the upper jaw, and five inner rows of much smaller teeth anteriorly, reduced to one inner row posteriorly; the body everywhere covered with medium-sized scales, apparently cycloid but really very finely ctenoid, the nape scaled forward halfway between the eyes with smaller scales than on the sides, the opercles and cheeks scaled as far as a perpendicular line from the eye to the angle of the mouth, ten rows of scales on the preopercle; the posterior margin of the preopercle finely toothed; the spinous portion of the dorsal low, the seventh spine longest and approximately one-third the depth, the rays higher, the antepenultimate longest, extending on the caudal when depressed, 1.1 to 1.2 times in the depth; the anal shorter and lower, 1.55 to 1.77 times in the depth; the depth of the caudal peduncle 1.12 to 1.32 times in its own length, 2.64 to 2.76 times in the head; the caudal subtruncate or with undulate margin, 4.4 to 4.7 times in the length; the long, narrow, pointed pectorals nearly equal to the depth, 1.1 to 1.2 times in the head, the lower rays abruptly shorter than the middle ones; the origin of the ventrals a little before that of the pectorals, the fins narrow, pointed, about 1.75 times in the head.

The color of fresh specimens was silvery, with a roseate flush along the upper half of the body, the snout bright deep pink; a pearl-colored band crossed the snout in front of the eyes; from the lower front margin of the eye a wide pearl band, rapidly narrowing, descended to the upper lip; from opposite the posterior margin of the pupil a silver band crossed the cheek nearly vertically to the throat; a large, dark brown spot above the origin of the lateral line; a black longitudinal line on the middle of the ridge crowning the nape; the dorsal spines with a black margin; the upper part of the entire dorsal was yellow, with a basal pearly band along its whole length; about six yellow bands on the upper two-thirds of the caudal, running back and a little diagonally upward, the lowest one separated from the rest; each scale above the lateral line with a small dark spot, these spots forming longitudinal rows; below the lateral line a pearly spot on each scale, these spots also forming faint lines; the pupil very large, black.

In alcohol the roseate flush and pink have disappeared and the fin markings are all gone; otherwise the color and markings are the same as when fresh.

Here described from three specimens, 240 millimeters long, collected by me in the Manila market.

Zenarchopterus cagayensis sp. nov.

Dorsal 12–13; anal 13; pectoral 1–9 or 1–8; scales in the lateral line 51–53 from tail to point of division below pectoral; 4 or 5 more to isthmus, 3 or 4 on vertical line to base of pectoral; 77 to over 80 scales from the upper angle of the gill opening to the caudal.

The elongate head and body laterally compressed, the breadth of the body 1.75 to 1.85 times in its depth, which is 7.6 to 7.85 times in the length; the head from the tip of the upper jaw 4.15 to 4.28 times in the length; the entire head to the tip of the lower jaw 1.8 to 1.95 times in the length; the lower beak, beyond the tip of the upper, 3.1 to 3.5 times in the length; the eye large, circular, very high up, its upper margin flush with the interorbital dorsal profile, 1.57 to 1.66 times in the postorbital part of the head and wider than the interorbital space, which is 0.85 to 0.96 of an eye diameter in breadth; the breadth of the triangular part of the upper jaw equals its length, scaly above, the front margin of the preorbital rounded, 2.16 to 2.33 times in the eye; the small conical sharp-pointed teeth in a band of four rows in each jaw, the bands widest anteriorly; the origin of the anal opposite the third or fourth dorsal ray; the dorsal low in females, much higher and centrally pointed in males; in the latter the fifth or sixth ray, or both, much elongated and thickened, the curved tip extending to or upon the caudal, the longest ray equal to the distance from the front margin of the eye to the posterior extremity of the head; the base of the anal 2.25 times in the length of the dorsal base; the anal in females unmodified, not concave; in males the anal rays in three groups, 5 + 4 + 4, the sixth ray greatly widened and thickened, but not greatly elongated, never reaching the caudal; the three succeeding rays similar but successively much narrower, the skin ascendant upon and adherent to them, the last four rays in a deep pit, the whole fin somewhat concave posteriorly; the narrow, pointed pectoral 1.56 to 1.7 times in the head to the tip of the upper jaw; the ventrals very far back, 2 to 2⅔ times in the length of the pectoral; the distance from the base of the ventrals to the caudal twice or about twice in the distance from the ventral base to the tip of the upper jaw; the caudal emarginate, the lower lobe somewhat larger and longer than the upper, 5.3 to 5.8 times in the length; the scales deciduous, especially ventrally.

The color in alcohol uniform yellowish brown, with a broad silver band from the angle above the pectoral base to the caudal, widest posteriorly, with a black line along its upper margin; the sides of the head silver, the opercle and side of the lower jaw brilliantly so; the beak blackish; the basal half of the dorsal, behind the fourth ray, black or blackish brown; the caudal more or less yellow or brownish on its base, the rays somewhat dusky; the other fins colorless.

Here described from nine specimens, 100 to 110 millimeters in length, from Pinacanauan River, Tuguegarao, Cagayan Province, Luzon. This is a fragile little fish and but a few of the specimens are in good condition.

PHALLOSTETHIDÆ

This extraordinary and anomalous group of little fishes, belonging to the order Cyprinodontes, seems to be well represented in the Philippines. In an earlier paper[2] I presented a new genus and two new species belonging to this family. I have just received from southeastern Luzon representatives of a new genus which has some characters not hitherto found in the family. In the genera heretofore known the head and nape are scaleless; in the one presented in this paper scales extend upon the head. The males in this family differ remarkably from the females in having a large muscular organ attached to the lower side of the head and throat, bearing one or two elongate, slender, external, more or less movable bones and a penislike structure, at the tip of which the vas deferens ends. This whole organ is a priapium, or copulatory organ. The intestine runs forward and coils within the priapium, opening upon its surface. For further details of family structure see my previous article cited above and also a paper by Regan.[3]

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[2] Philip. Journ. Sci. 27 (1925) 507–511.

[3] Proc. Zool. Soc. London 1 (1916) 1–26.

In the genus here described the priapium has some features not found among the previously known members of the order.

As yet this group of fishes is known only from brackish water in Johore and Singapore and from fresh-water lakes and mountain streams of Luzon.

Key to the genera of Phallostethidæ.

a^1. Two dorsal fins, the first of two spines .... **Gulaphallus.**

a^2. One dorsal fin.

  b^1. Nape scaled almost to eyes; opercles scaled; teeth in three or four rows; dorsal 1–6, males with a long external rodlike priapial bone and a very short curved one beside it.................. **Mirophallus.**

  b^2. Head and nape naked; teeth in one or two rows.

    c^1. Dorsal 5 or 6; anal 1–12 to 16; scales 34 to 37; males with a long, smooth, curved external bone (or two?), the ctenactinium, on the priapium.. **Neostethus.**

    c^2. Dorsal 1–7 to 9; anal 1–25 to 27; scales 40; males with an anterior, smooth, rodlike external bone, the toxactinium, and a latero-posterior serrated external bone, the ctenactinium, on the priapium .... **Phallostethus.**

Genus MIROPHALLUS novum

This genus differs from the other members of the Phallostethidæ in having scales on the nape and posterior part of the head up to the interorbital space, and in having the opercles covered by a few large scales. In addition, the males have a priapium unlike that of other genera. In *Mirophallus* the priapium is shaped something like a scalene triangle, its long side attached to the underside of the head and throat, from the posterior part of the lower jaw to beneath the base of the pectoral. The lower posterior angle of the priapium is irregular in shape, with a rounded protruding hump which bears on one side a long, slender, cylindrical bone extending forward as far as the mouth and curving over to the opposite side from its origin; this is the equivalent of the toxactinium in Regan's description of *Phallostethus;* in the inner angle and at one side of its expanded base is a short, curved, projecting organ with a supporting bone which projects in a very short sharp claw at the tip; this seems to be the equivalent of the bone on *Phallostethus* named the ctenactinium by Regan; the priapium ends at its posterior angle in a soft hump from which grows a small, very slender, curved and twisted, apparently tubulate organ which is recurved upon the priapium and fits into the hollow between its origin and the base of the toxactinium, its more or less hard and semiosseous tip projecting upward between the base of the toxactinium and the ctenactinium; at its tip is the opening of the vas deferens.

The priapium does not extend down very far, but is folded over near its middle so that it fits closely against the head and throat; the toxactinium then lies along the surface, its tip curving across the base of the lower jaw; the appendages of the priapium may be on either the right or the left side; when the priapium is unfolded, as it must be in copulation, it hangs down as far as the abdominal outline and its appendages are in a position very different from the usual one.

In the female the priapium is represented by a broad thickened ridge; on its anterior half in the median line is the anal opening and a little back of the middle is the larger genital opening; at the posterior end is a short thick fleshy papilla. Vertebræ 33.

Mirus, wonderful; *phallus*, the copulatory organ.

Mirophallus bikolanus sp. nov.

Dorsal 1–6; anal 1–14; there are 32 scales in a longitudinal series, 6 in a vertical series from the origin of the dorsal, and 25 before the first dorsal.

The head and body strongly compressed laterally, slender, elongate, the dorsal profile nearly horizontal, the ventral profile more or less convex. In females the depth is 4.6 to 5 times, the head 4.3 to 4.5 times in the length; the head pointed, with short, blunt snout, nearly vertical mouth, and strongly projecting chin, the tip of which rises to the dorsal profile; the large circular eye very high up, lateral, 2.5 to 2.8 times in the head, from a little more to half more than the snout; the broad flat or nearly flat interorbital a tenth to a fourth more than the eye; the very minute teeth in bands; there are three rows in the upper jaw, and four in the lower jaw; the lower band divided into two parts by a toothless space at the middle, the whole band crescent-shaped; the posterior margin of the maxillary in advance of or extending to a point beneath the front margin of the eye; the dorsal highest anteriorly, $1\frac{2}{3}$ times to twice in the head, very far back; the anal much longer than the dorsal, its origin much in advance of the dorsal but in the posterior half of the body, the spine low but the anterior rays high, becoming progressively shorter posteriorly, 1.5 to 1.7 times in the head; the pointed pectoral 1.2 to 1.3 times in the head; the caudal elongate, narrow, truncate, equal to or longer than the head, rarely a little shorter, 3 to 4.6 times in the head.

Males a trifle slenderer, the depth 4.9 to 5.2 in the head, 5.5 to 5.7 times in the length; the eye 2.2 to 2.3 times in the head, and about a tenth less than the interorbital; the snout 1.2 to 1.8 times in the eye; in other measurements of the body and fins they do not differ from the females.

The color in alcohol whitish with a thin black line on the side, beginning high up a little before and above the posterior end of the pectoral and running back to the middle of the caudal; the dorsal scales outlined by circular black dots; the top of the head black, the snout, sides of the head, and chin thickly sprinkled with black dots; beginning forward of the anal fin a black line or row of black dots extends back at the base of the anal until it meets its fellow from the opposite side at the posterior end of the fin, and the two continue as one along the median line to the caudal; the dorsal and caudal are dusky, the other fins clear. In males the ventral surface of the folded priapium more or less blackened.

I have examined twenty-eight female specimens, 15 to 24 millimeters in length, and twenty-two males, 16 to 24 millimeters in length, from Lake Bato, Camarines Sur Province. From Lake Lanigay, Albay Province, I have four females, 19 to 27 millimeters long, and three males, 22 to 23 millimeters in length.

This tiny fish is entirely unlike any other member of the family yet described.

Bikolanus, pertaining to the Bikol provinces.

ILLUSTRATIONS

PLATE 1

Canthidermis viola sp. nov., × ⅓. (Drawing by Antonio Canlas.)

PLATE 2

Branchiostegus vittatus sp. nov., × ⅔. (Drawing by J. L. Nievera.)

PLATE 3. MIROPHALLUS BICOLANOS SP. NOV., × 3⅓. (Drawings by Pablo Bravo.)

FIG. 1. Adult male, lateral view, showing the toxactinium in a folded position; *p*, penal structure; *c*, ctenactinium; *t*, toxactinium.

FIGS. 2 to 4. Adult male, partial views, showing the toxactinium in an unfolded position; *2*, ventral view of head; *3*, left side view of head; *4*, right side view of head.

FIG. 5. Adult female, lateral view; *o*, oviduct; *a*, anus.

6. Adult female, ventral view of head.

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FIG. 5. Adult female, lateral view; *o*, oviduct; *a*, anus.

6. Adult female, ventral view of head.

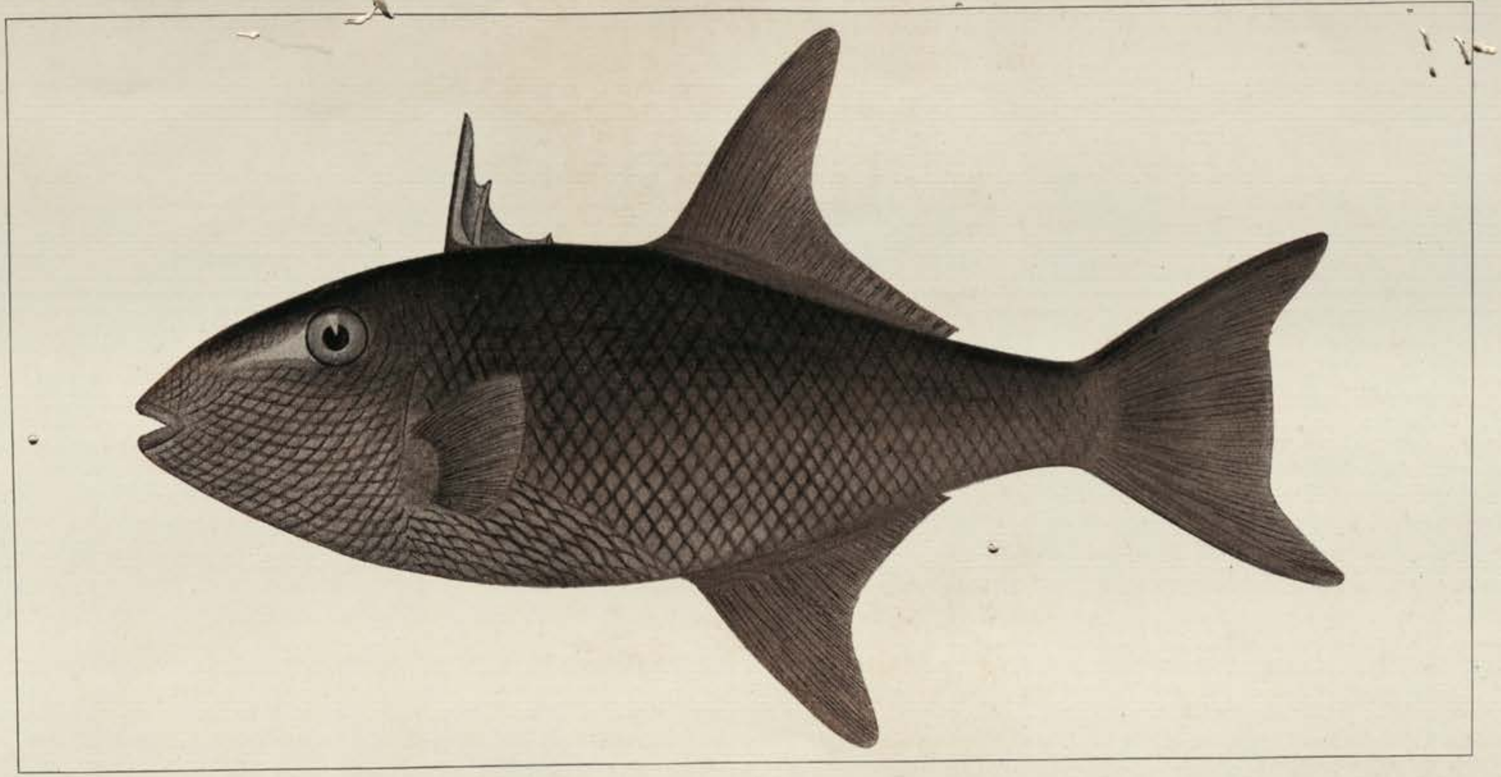

PLATE 1. CANTHIDERMIS VIOLA SP. NOV.

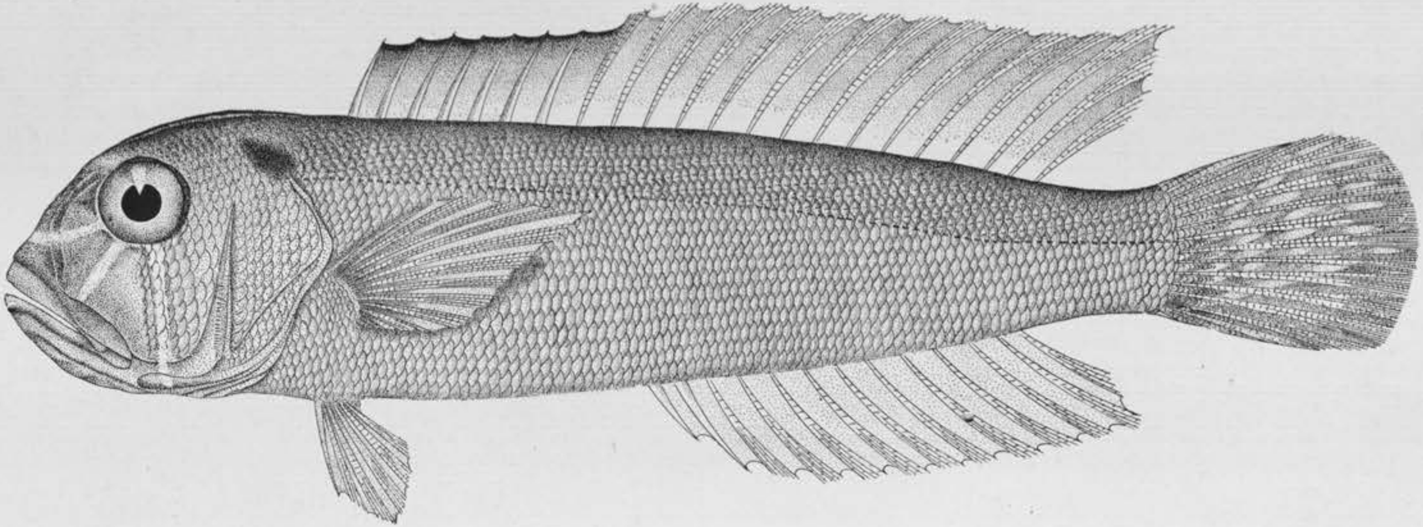

PLATE 2. BRACHIOSTEGUS VITTATUS SP. NOV.

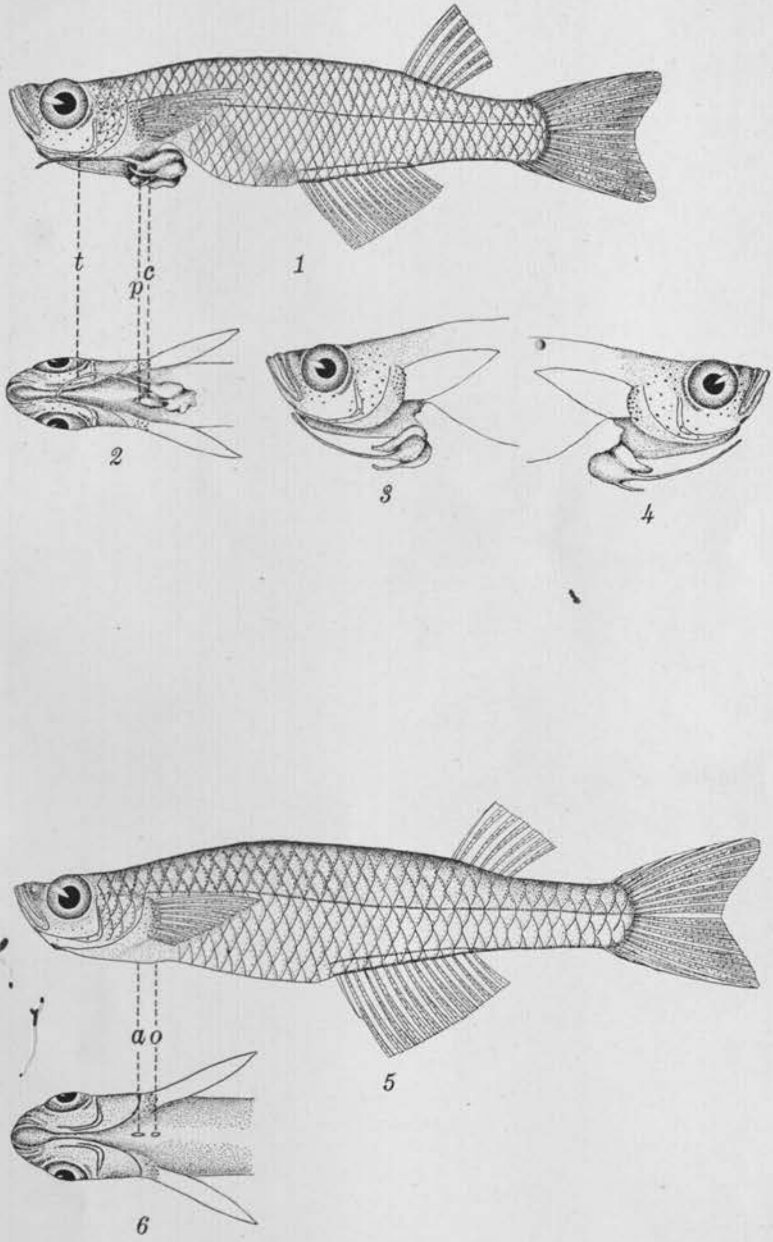

PLATE 3. MIROPHALLUS BIKOLANUS SP. NOV.

ERRATA

Volume 30, page 413, line 18, for *hirtella* (Ridl.) comb. nov. read *hirtella* (Ridl.) Merr.

VOLUME 31

Page 105, line 11, *for* **Leptotrichalus effeminautus** Kleine. *read* **Leptotrichalus effeminatus** Kleine.

Page 260, line 34, *for* **P. brevicristatus** var. **deletus** Fauvel. *read* **T. brevicristatus** var. **deletus** Fauvel.

Page 260, line 45, *for* **P. longipennis** sp. nov. *read* **T. longipennis** sp. nov.

Page 261, line 2, *for* **P. philippinus** sp. nov. *read* **T. philippinus** sp. nov.

Page 261, line 13, *for* **P. minutissimus** sp. nov. *read* **T. minutissimus** sp. nov.

INDEX

[New generic and specific names and new combinations are printed in clarendon; synonyms and names of species incidentally mentioned in the text are printed in *italic*.]

A

Abalistes, 533.
Acanthocladium Mitt., 294.
    hornschuchii (Doz. & Molk.), 295.
    (Tanythrix) **benguetense** Broth., **294**.
Acanthogenius Reiche, 351, 358.
Acarus scabiei, 131.
Aclotoxenus Frauenfeld, 492.
Acroporium Mitt., 269.
    sigmatodontium (C. Müll.) Fleisch., 297.
    subulatum (Hamp.), 296.
Actia apicupunctata Malloch, **510**.
Acupalpus Latr., 346.
    annamensis Bates, 346, 358.
Aephnidius MacL., 346.
    adelioides MacL., 346, 358.
    australis Sloane, 346, 358.
    sericeus Zimm., 346, 361.
    simplex Schm. Goeb., 346, 361.
Aërobryopsis Fleisch., 288.
    lanosa (Mitt.) Broth., 288.
Agonothorax Motsch., 347, 358.
Agonum Steph., 347, 358.
Agrilus mcgregori, Fisher, **242**.
    occipitalis Eschsch., 242.
    quadriplagiatus Fisher, 244.
    spinellifer Oberb., 244.
Agromyzidæ, 492.
ALEXANDER, CHARLES P., New or little-known Tipulidæ from eastern Asia (Diptera), Part I, 363.
Allocota Motsch., 346.
    cyanipennis Heller, 346, 359.
    viridipennis Motsch., 346, 361.
Alstonia scholaris R. Br., 415–418, 422, 423.
    scholaris R. Br., bark of, from the Philippines, 415.
Amblystomus Erichs., 346, 358.
    guttatus Bates, 346, 359.
    quadriguttatus Motsch., 346, 360.
Amorphosomus marmoreus H. Deyr., 241.
Anaulacus MacL., 346.
    fasciatus Schm. Goeb., 346, 359.
    fasciatus var. basalis Fleut., 346.
    fasciatus var. philippinensis Heller, 346.
    sericipennis MacL. var. *philippinensis* Heller, 346, 361.
Anchista Nietn., 346.
    binotata Dej., 346, 359.
    discophora Chaud., 346, 359.
    signifera Bates, 346, 361.
Anchomenus Steph., 347, 358.
    nigrosericans Heller, 347, 360.
    quadripunctatus DeG., 347, 360.
ANDREWES, H. E., A catalogue of Philippine Carabidæ, 345.
Anoplogenius Chaud., 347.
    microgonus Bates, 347, 360.
Antocha, 365.
    (Antocha) **confluenta** Alex., **364**.
Apotomus Ill., 347.
    ? *fuscus* Motsch., 347, 359.
    sumbawanus Heller, 347, 361.
    xanthotelus Bates, 347, 361.
Apristus Chaud., 347.
    cuprascens Bates, 347, 359.
Apsectra Schm. Goeb., 353, 358.
Arame Andr., 352, 358.
Arichelonus Viereck, 452.
Ariidæ, 386, 393, 394.
Ariodes Bleeker, 394, 396.
    goniaspis Bleeker, 401.
    leiocephalus Bleeker, 399.
    tonggol Bleeker, 398.
Aristolebia Bates, 347, 358.
    davaonis Heller, 347, 359.
Arius Cuv. & Val., 394, 405.
    argyropleuron, 396.
    crossocheilus Bleeker, 396, 398.
    crossocheilus Weber and Beaufort, 398.
    dispar Herre, 396, **405**.
    falcarius Meyer, 402, 405.
    goniaspis Bleeker, 396, 401.
    leiotetocephalus Bleeker, 396, 399.
    liocephalus Gthr., 399.
    maculatus, 396.
    magatensis Herre, 395, **396**.
    manillensis Cuv. & Val., 396, 402, 405.
    meyenii Müller & Troschel, 399.
    nasutus (Cuv. & Val.), 407.
    thalassinus Gthr., 396, 407, 409.
    thalassinus (Rüpp.), 407.
    tonggol Bleeker, 398.
Ascogaster Wesm., 454, 466, 483.
    argentea Fullaway, 467.
    australiensis Szepl., 468.
    caudata Szepl., 469.
    cinctus Baker, 469, **477**, 479.
    detectus Baker, 469, **478**.
    distinctus Baker, 469, **481**.
    erythropus Cam., 468.
    inconspicuus Baker, 453, 467, **470**, 471.

Ascogaster—Continued.
    intensus Baker, 453, **468**, **473**.
    laeviventris Baker, **468**, **475**, **478**.
    longulus Baker, **468**, **471**.
    luzonensis Baker, 453, **467**, **470**.
    maculaticeps Baker, **469**, **482**.
    modestus Baker, **468**, **474**.
    novoguineensis Szepl., 469, 478.
    palpalis Szepl., 453, 468, 474.
    philippinensis Baker, **468**, **472**.
    rugosa Fullaway, 483.
    tegularis Szepl., 468.
    tricolor Szepl., 469, 479, 480.
    vividus Baker, **469**, **479**, 481, 482.
Atherigona **seticauda** Malloch, **504**.
    varia Meig., 505.

B

Bagrus thalassinus Rüpp., 107.
Bak'c, 389.
BAKER, CHARLES FULLER, Braconidæ-Cheloninæ of the Philippines, Malaya, and Australia, I. Chelonini (except Chelonus), 451.
Baklad, 395.
Balistapus, 533.
Balistes, 533.
Barbula Hedw., 281.
    comosae Doz. & Molk., 282.
    consanguinea Mitt., 281.
    hygrophila Fleisch., 282.
    inflexa C. Müll., 281.
    (Eubarbula) **subulata** Broth., **282**.
    (Hydrogonium) **edanoi** Broth., **282**.
Bartramiaceæ, 285.
Batan texts with notes, 301.
Batoscelis Schm. Goeb., 353, 358.
Belionota fallaciosa H. Deyr., 241.
    sagittaria Eschsch., 241.
Belonognatha Chaud., 349, 358.
Bembidion Latr., 347.
    bakeri Andr., 347, 358.
    batesi Putz., 347, 358.
    hamatum Kol., 347, 359.
    niloticum Dej., 347, 360.
BERNHAUER, MAX, Die Staphyliniden der Philippinen: 21. Beitrag zur Indo-Malayischen Staphyliniden-Fauna, 245.
Bitomus Szepl., 452, 453.
Blechrus Motsch., 352, 358.
Blemus Dej., 354, 358.
Blemus Steph., 357, 358.
Brachidius Chaud., 347.
    corpulentus Chaud., 347, 359.
    crassicornis Chaud, 347, 359.
Brachinus Web., 347.
    luzonicus Chaud., 347, 360.
    piceus Chaud., 347, 360.
Brachyctis Chaud., 347.
    rugulosa Chaud., 347, 361.
Brachymenium Schwaegr., 283.
    nepalense Hook., 283.
Brachytheciaceæ, 292.
Braconidæ-Cheloninæ of the Philippines, Malaya, and Australia, 451.
Branchiostegidæ, 535.
Branchiostegus Raf., 535.
    vittatus Herre, **535**.
BROTHERUS, V. F., Contributions to the bryological flora of the Philippines, VI, 277.
Bryaceæ, 283.
Bryantina Malloch, **506**.
    javensis Malloch, **506**.
Bryological flora of the Philippines, 277.
Bryum (Dill.) Schimp., 283.
    ambiguum Dub., 283.
    coronatum Schwaegr., 284.
    ramosum (Hook.) Mitt., 284.
Bulenides Waterh., 83.
    adumbratus Kln., 38, 83, **84**, **85**.
    adventicius Kln., 38, **84**, 85, **86**.
    aterrimus Kln., 38, 83, **85**.
    parvulus Kln., 38, **85**, **86**.
Buprestidæ, 235.
Buprestis fulminans F., 235.
    occipitalis Eschsch., 242.

C

Caelostomus MacL., 349, 358.
    picipes MacL., 349, 360.
    rufipes Boh., 349, 361.
    striaticollis Chaud., 349, 361.
Calleida Latr. & Dej., 347.
    discoidalis Heller, 347, 359.
    splendidula F., 348, 361.
    splendidula var. **rubricata** Motsch., **348**.
Callicostella (C. Müll.) Mitt., 290.
    beccariana (Hamp.) Jaeg., 290.
    papillata (Mont.) Mitt., 290.
Calochromus Guer. Men., 35.
    conveniens Kln., 36, 40, **41**, 42, **43**.
    macropalpis Kln., 36, **40**, **43**.
    orbatus Waterh., 33, 35, 36, 40, 43.
    palawanus, 40.
    pallidulus Kln., 36, **42**, **43**.
    pallidulus macropalpis, 43.
    sororius Kln., 36, **40**, **43**.
Calymperaceæ, 280.
Calymperes Sw., 281.
    orientale Mitt., 281.
    orientale Mitt. var. polytrichoides Fleisch., 281.
    (Hyophilina) **ramosi** Broth., **281**.
Calyptothecium Mitt., 289.
    tumidum (Mitt.) Fleisch., 289.
Campylodontium Doz. et Molk., 293.
    flavescens (Hook.), 293.
Campylopus Brid., 277.
    foxworthyi Broth., **277**.
Canthidermis Swainson, 533.
    viola Herre, **534**.
Carpaulm Sloane, 355, 358.

Cacogaster Baker, 453, 454, 482.
  coelioxoides Baker, 483, 486.
  fullawayi Baker, 483, 485-487.
  fullawayi var. maquilingensis var. Baker, 485.
  malayensis Baker, 483, 485, 486.
  rugosa Fullaway, 483, 486.
Casnoidea Cast., 353, 358.
Casnonia Latr. & Dej., 352, 358.
Castalia obsoleta Chevr., 235.
Catascopus Kby., 348.
  aequatus Dej., 348, 358.
  elegans Web., 348, 359.
  facialis Wied., 348, 359.
  simplex Chaud., 348, 361.
  smaragdulus Dej., 348, 361.
  teste Bates, 348.
Catfish, 389, 394.
Cautires Waterh., 81, 82.
  coronarius Kln., 88, 82, 83.
  exploratus Kln., 88, 82, 83.
Cebus capucinus, 2.
Celaenephes Schm. Goeb., 348.
  parallelus Schm. Goeb., 348, 360.
Chaetomitriopsis Fleisch., 291.
  glaucocarpa (Reinw.) Fleisch., 291.
Chaetomitrium Doz. & Molk., 290.
  elmeri Broth., 290.
  orthorrhynchum Doz. & Molk., 290.
  perarmatum Broth., 290.
Chalcidomyia de Meij., 494.
  aeneiventris de Meij., 494.
  apicalis de Meij., 494.
Chalcophora wallacei Thoms., 236.
Chelonella Szepl., 452.
Chelonini, 453.
Chelonus Jurine, 451, 454, 455, 460, 466, 475, 480.
Chlaenius Dej., 348.
  aeruginosus Chaud., 348, 358.
  biguttatus Montr., 348, 358.
  bimaculatus Dej., 348, 359.
  binotatus Dej., 348, 359.
  flaviguttatus MacL., 348, 359.
  flaviguttatus var. guttatus Eschsch., 348.
  guttula Chaud., 348, 359.
  guttula var. cuspidatus Heller, 348.
  hamatus Dej., 348, 359.
  leucops Wied., 348, 360.
  luzonicus Chaud., 348, 360.
  maculifer Cast., 348, 360.
  punctatus Chaud., 348, 360.
  puncticeps Mun. Cat., 348, 360.
  semperi Chaud., 348, 361.
Chloropidæ, 494.
Chloropinæ, 494.
Chrysobothris pictiventris Saunders, 241.
Chrysochroa (Chrysochroa) fulminans F., 235.
Chrysodema antennata Saunders, 240.
  cavifrons Fisher, 236, 238.
  dohrni Saunders, 238.
Chrysodema—Continued.
  eximia Cast. & Gory, 238.
  flavicornis Saunders, 236.
  granulosa Kerrem., 240.
  hebes Kerrem., 240.
  samarensis Fisher, 238.
  (Thymedes) flavicornis Saunders, 236.
Cisseiscoraebus grandis Kerrem., 242.
Cladophorus Guér, Men., 34, 81, 82.
  fragilis Kln., 38, 81.
Cladopodanthus Doz. et Molk., 279.
  muticus Broth., 279.
Cladura autumna Alex., 370.
  bidens Alex., 369.
  megacauda Alex., 370, 371.
  nipponensis Alex., 370.
Clariidæ, 386.
Clavilispinus Bernh., 255.
Clivina Latr., 348.
  castanea Westw., 348, 359.
  clivinoides Schm. Goeb., 348, 359.
  humilis Morow., 349, 359.
  lata Putz., 348, 360.
  parryi Putz., 348, 360.
  vulgivaga Boh., 349, 361.
Coelioxys, 487.
Coeloprosopus Chaud., 353, 358.
Coleoptera, 235.
Colpodes MacL., 349.
  abropoides Chaud., 349, 358.
  amoenus Chaud., 349, 358.
  andrewesi Heller, 349, 358.
  apicalus Chaud., 349, 358.
  buchanani Hope, 349, 359.
  cyanipennis Chaud., 349, 359.
  dohrni Nietn., 349, 359.
  laetus Erichs., 349, 360.
  luzonicus Chaud., 349, 360.
  obscuritarsis Chaud., 349, 360.
  ruficeps MacL., 349, 360.
  rufitarsis Heller, 349, 361.
  schmidti Chaud., 349, 361.
  splendens Morow., 349, 361.
Conderis, 68.
Congenital absence of both hind legs in an adult pig, 147.
Copidoglanis albilabris Gthr., 388.
Coptodera Dej., 349, 358.
  elegantula Bates, 349, 359.
  eluta Andr., 349, 359.
  flexuosa Schm. Goeb., 349, 359.
  interrupta Chaud., 349, 359.
  tetrastigma Chaud., 349, 361.
Coraebus grandis Kerrem., 242.
Crocidolomia binotalis, 451.
Crossoglossa Chaud., 354, 358.
Cryphaeaceæ, 287.
Cryptodactylus philippinensis Saunders, 242.
Cubochelonus Baker, 453, 455.
  luzonicus Baker, 455, 457.
  tagalicus Baker, 455.

Cyclodictyon Mitt., 290.
    blumeanum (C. Müll.) Broth., **290**.
Cyclosomus Latr., 349.
    philippinus Heller, 349, 360.
Cylindromyia Meig., 508.
Cylindromyiella Malloch, **508**.
    bakeri Malloch, **508**.
Cyrtopterus Motsch., 352, 358.

D

Dactylolabis **gracilistylus** Alex., **372**.
    longicauda Alex., 372.
Dawsonia R. Br., 300.
    superba R. Br., 300.
Dawsoniaceæ, 300.
Dendrocellus Schm. Goeb., 349, 358.
Desera Hope, 349, 358.
    geniculata Klug, 349, 359.
    schultzei Heller, 349, 361.
Dicercomorpha albosparsa Cast. & Gory, 240, 241.
    albosparsa var. **nigroviridis** Fisher, **240**.
Dichaetomyia Malloch, 494.
Dicranaceæ, 277.
Dicranella Schimp., 277.
    coarctata (C. Müll.), 277.
Dicranodontium, 278.
    brachydictyon Broth., **278**.
    nitidum (Doz. et Molk.) Fleisch., 278.
Dicranoloma Ren., 278.
    braunii (C. Müll.) Par., 278.
    leucophyllum (Hamp.) Par. var. kurzii (Limpr.), 278.
    reflexum (C. Müll.) Ren., 278.
Dicranomyia morio, 363, 364.
    paramorio Alex., **363**.
    pseudomorio Alex., 364.
Dicranoncus Chaud., 350.
    amabilis Chaud., 350, 358.
    ruficeps Br., 350, 360.
Dicraspeda Chaud., 350, 358.
    brunnea Chaud., 350, 359.
    nitida Sloane, 350, 360.
Didetus Lec., 353, 358.
Dihammatus Waterh., 68.
    abditus, Kln., 37, **69**, **70**.
    abjectus Kln., 37, 69, 70.
    orientalis Kln., 37, 69, 70.
    pallens Waterh., 33, 37, 68, 70, 71.
Dilophotes Waterh., 68, 75.
    abnormis Kln., 37, 75, 76, **77**.
    comes Kln., 38, 76, **77**.
Dioryche MacL., 350.
    amoena Dej., 350, 358.
    laetula Bates, 350, 360.
    torta MacL., 350, 361.
Diphysciaceæ, 300.
Diphyscium, 300.
    involutum Mitt., 300.
Diplocheila Br., 350, 358.
    colossus Bates, 350, 359.
    impressa Redt., 350, 359.
    laevigata Bates, 350, 360.
Diplocheila—Continued.
    moesta Bates, 350, 360.
    polita MacL., 350, 360.
Diplodia, 169, 175–182, 185, 187–198, 202–204, 208, 211.
    zeae (Schw.) Lev., 169, 172, 210.
Dischissus Bates, 350.
    longicornis Schaum, 350, 360.
    notulatus F., 350, 360.
    sumatranus Dohrn, 350, 361.
Distichophyllum Doz. et Molk., 289.
    nigricauli Mitt., 290.
    subnigricaule Broth., **289**.
Dita, 415.
Ditoneces Waterh., 46, 61.
    aemulus Kln., 37, 62, 64, 65, 66, 68.
    aestimabilis Kln., 37, 61, 63, **65**, **67**.
    affinis Kln., 37, 63, **67**.
    afflictus Kln., 37, 61, 62, **67**.
    alienus Kln., 37, 63, **67**.
    consociatus Kln., 37, 62, 63, **67**.
    consonus Kln., 37, 62, **67**.
    conspectus Kln., 66.
    contemptus, 65.
    conterminus Kln., 37, 64, 65, 66, **67**.
    continuus Kln., 37, 66, 68.
    philippinensis Bourg., 33, 37, 61, 62, 67.
    pilicornis Blanch., 33.
    pilosicornis Blanch., 37, 66, 68.
    promiscuus Kln., 37, **64**, **67**.
    pusillus Bourg., 33, 37, 64, 67.
Dolichoctis Schm. Goeb., 350.
    gilvipes Dej., 350, 359.
    tetracolon Chaud., 350, 361.
Drosophila, 491, 492.
Drosophilidæ, 491.
Drypta Latr., 350.
    lineola MacL., 350, 360.
    lineola var. philippinensis Chaud., 350.
Dyscolus Dej., 349, 358.

E

Eccoptogenius Chaud., 350, 358.
Echites scholaris Linn., 415.
Ectropothecium Mitt., 298.
    brachyphyllum Broth., 299.
    cyperoides (Hook.) Jaeg., 299.
    falciforme (Doz. et Molk.), 299.
    ferrugineum (C. Müll.) Jaeg., 298.
    luzoniae (C. Müll.) Broth., 298.
    monumentorum (Dub.) Jaeg., 298.
    subintorquatum Broth., 299.
Egadroma Motsch., 355, 358.
Eleusis Cast., 246.
    alternans Bernh., **252**.
    alutiventris Bernh., **248**.
    angusticeps Bernh., **249**, 251.
    atriceps Bernh., **250**, 251.
    augustae Bernh., **247**.
    banghaasi Bernh., **253**.
    banosana Bernh., **251**.
    brunnea Bernh., **249**.
    circuliceps Bernh., **252**.

Eleusis—Continued.
  crassicornis Bernh., **250**.
  densiceps Bernh., **254**.
  discalis Fauvel, 249.
  divergens Bernh., **247**.
  flaviceps Bernh., **249**.
  fuscicepe Kraatz, 253.
  iridescens Bernh., **254**.
  kraatzi Fauvel, 251, 253.
  luzonicus Bernh., **247**.
  montana Bernh., **251**.
  obscuriceps Bernh., **251**.
  ocellatus Bernh., **252**.
  palawanensis Bernh., **249**.
  paralleliceps Bernh., **254**.
  pennata Bernh., **253**.
  phaenomenalis Bernh., **246**.
  philippinus Bernh., 253.
  philippinus var. **longelytrata** Bernh., **253**.
  philippinus var. **longipennis** Bernh., **253**.
  quadraticeps Bernh., **248**.
  rufotestacea Bernh., **251**.
  sculpticeps Bernh., **251**.
  soror Bernh., **253**.
  speculiceps Bernh., **250**, 251.
  speculipennis Bernh., **248**.
  splendida Bernh., **252**.
  strigiceps Bernh., **249**.
  sulciceps Bernh., **247**.
Elliotia Nietn., 353, 358.
Endothia parasitica, 172.
Endotrichella C. Müll., 287.
  elegans (Doz. & Molk.) Fleisch., 287.
Endynomena Chaud., 350, 358.
  inconspicua Blackb., 350, 359.
  pradieri Fairm., 350, 360.
Entodon C. Müll., 293.
  longidens Broth., 293.
Entodontaceæ, 293.
Epidelus philippinensis, 236.
  wallacei Thoms., 236.
Erioptera (*Erioptera*) *elegantula* Alex., 368.
  (Erioptera) **harukawai** Alex., **368**.
  (*Ilisia*) *asymmetrica* Alex., 380.
Erythrodontium Hamp., 293.
  julaceum (Hook.) Par., 293.
Esakiomyia Alex., 373, 374.
Espeson Schauf., 261, 262.
  angustissimus Bernh., **261**.
  indomalayensis Bernh., **262**.
  luzonicus Bernh., **262**.
  philippinus Bernh., **262**.
Esters of chaulmoogric acid (capryl, allyl, phenyl, ortho cresol, meta cresol, para cresol), 161.
Eudalia Cast., 350, 358.
Eumyiospila Malloch, 494, 499.
  contraria Walk., 499, 501.
  spinifemorata Malloch, 499, **500**.
Eupiestus Kraatz, 245.
  longicornis Fauvel, 246.
  luzonicus Bernh., **246**.
  philippinus Bernh., **246**.
  sculpticollis Kraatz, 245.
Euplynes Schm. Goeb., 351.
  cyanipennis Schm. Goeb., 351, 359.
Euschizomerus Chaud., 351.
  rufipes Heller, 351, 361.
  rufipes var. pilosulus Heller, 351.
Experimental pneumonia in monkeys, 1.
Extromus Péring, 354, 358.

F

Fauna samarensis, 85.
FISHER, W. S., Fauna samarensis: Coleoptera, Buprestidæ, 235.
Flagellata from North Manchuria, China, 229.
Fleischerobryum Loesk., 285.
  longicolli (Hamp.) Loesk., 285.
  macrophyllum Broth., **285**.
Floribundaria C. Müll., 288.
  floribunda (Doz. & Molk.) Fleisch., 288.
Funaria Schreb., 283.
  calvescens Schwaegr., 283.
Funariaceæ, 283.
Fusarium, 187–191, 193–195, 198, 208.
  moniliforme, 169.

G

Gagu'k, 394.
Garovaglia Endl., 287.
  punctidens Williams, 287.
Gastrotheca Guer., 452.
  sumatrana End., 487.
Gempylidæ, 217.
Gempylus prometheus Cuv. & Val., 218.
  solandri Cuv. & Val., 218.
Geomyzidæ, 493.
Globulin precipitation test, 431.
Glossadelphus Fleisch., 298.
  (Anastigma) **bakeri** Broth., **298**.
Gnathaphanus MacL., 351, 358.
  dispellens Walk., 351, 359.
  gnathaphanoides Bates, 351, 359.
  impressipennis Cast., 351, 359.
  javanus Dej., 351, 359.
  laeviceps W. MacL., 351, 360.
  melanarius Boh., 351, 360.
  philippensis Chevr., 351, 360.
  punctilabris MacL., 351, 360.
  subcostatus Dej., 351, 361.
  vulneripennis MacL., 351, 361.
Gollania Broth., 299.
  benguetensis Broth., 299.
Gonomyia sachalinensis, 369.
  (Ptilostena) **kuwayamai** Alex., **368**.
  (*Ptilostena*) *sachalinensis* Alex., 368.
Graphomyia R.-D., 506.
Gryllacris arctatiformis, 528.
  chopardi, 526.
  cyanipes Karny, 517, 520, 521.
  fasciculata, 517.
  fumigata, 517.
  grassii, 520.
  horváthi, 520.
  infumata, 525, 526.
  isseli Griffini, 515, 516.
  lalbaumei, 520.

Gryllacris—Continued.
    longispina Karny, 526, 528.
    maculipennis bakeri Griffini, 528.
    martha, 520.
    nasalis detersa Griffini, 529.
    nigrogeniculata, 516.
    nigrogeniculata tristis Karny, 515, 516.
    pallidula, 528.
    patellaris Karny, 523, 525, 526.
    personata, 520.
    plebeia Stål, 515.
    plebeia connexa, 526.
    plebeia subsp. immaculata Griffini, 515, 528.
    primi-genii, 520.
    punctifrons, 525.
    recticauda Karny, 521–523, 526.
    recticauda subsp. ochrocnemis Karny, 522, 523.
    recticauda subsp. ochropis subsp. Karny, 521, 522, 523.
    signifera, 518.
    solitaria, 528.
    venosa, 518–520.
Gulai, 395.
Gulaphallus, 539.

H

Haplopisthius Chaud., 353, 358.
Hebecnema luzonensis Malloch, 501.
    nigrithorax Stein, 501, 502.
Helina R.-D., 494, 498, 502.
    coronata (Stein), 495, 496.
    flavidipennis (Stein), 495, 497.
    hirtifemorata Malloch, 495.
    mindanaensis Malloch, 495, 496.
    nigroabdominalis Malloch, 495, 497.
    otanesi Malloch, 498.
    propinqua (Stein), 498.
Helinella Malloch, 494, 498.
    otanesi Malloch, 499.
    propinqua (Stein), 498.
Hemipimelodus Bleeker, 394, 409.
    manillensis (Cuv. & Val.), 410.
    manillensis Jordan and Richardson, 410.
HERRE, ALBERT W., Four rare Philippine fishes, 217; A summary of the Philippine catfishes, order Nematognathi, 385; Four new Philippine fishes, 533.
HERRERA-BATTEKE, P. P., and AUGUSTUS P. WEST, Esters of chaulmoogric acid (capryl, allyl, phenyl, ortho cresol, meta cresol, para cresol), 161.
Himanthocladium (Mitt.) Fleisch., 289.
    loriforme Fleisch., 289.
Hispalis Ramb., 346, 358.
Hololeius Laferté, 351.
    ceylanicus Nietn., 351, 359.
    nitidulus Dej., 351, 360.
    ? *ornatus* Tryon, 351, 360.
    punctulatus Chaud., 351, 360.
Holosus Motsch., 256, 259.
    bifoveolatus Bernh., 258.
    boettcheri Bernh., 257.
Holosus—Continued.
    cordicollis Bernh., 256.
    ferrugineus Bernh., 258.
    foveolatus Motsch., 256, 257.
    insularis Fauvel, 257, 258.
    luzonicus Bernh., 258.
    mycetoporiformis Motsch., 257.
    palawanensis Bernh., 257.
    pallidus Bernh., 258.
    paradosus Bernh., 256.
    parcestriatus Fauvel, 257.
    philippinus Bernh., 257.
    piceolus Bernh., 258.
    plicatus Bernh., 257.
    rufotestaceus Bernh., 258.
    socius Bernh., 256.
Homaliodendron Fleisch., 289.
    flabellatum (Dicks.) Fleisch., 289.
Hookeriaceæ, 289.
Hoplomenes Heller, 347, 358.
Hydnocarpus, 162.
Hyophila Brid., 283.
    micholitzii Broth., 283.
Hypnaceæ, 298.
Hypnodendraceæ, 284.
Hypopterygiaceæ, 291.
Hypopterygium Brid., 291.
    ceylanicum Mitt., 291.

I

Iito, 389.
IMPERIAL, GERARDO A., and AUGUSTUS P. WEST, Salts of linolenic hexabromide from lumbang oil, 441.
Iridotaenia cupreomarginata Saunders, 236.

K

Kanduli, 394, 395.
KARNY, H. H., Philippine cricket-locusts (Gryllacridæ), 515.
KLEINE, R., Die Lyciden der Philippinen-Inseln, 33.

L

Labrus latovittatus Lacép., 220.
Langpoi, 218.
Larnaca, 526.
Latilus Cuv. & Val., 535.
Leipophorus, 261.
Leprosy in children of lepers, 115.
Leptodactyla Brullé, 352, 358.
Leptotrichalus Kln., 84, 101, 107.
    accuratus Kln., 39, 102, 106.
    acerbus Kln., 39, 104, 106.
    acidus Kln., 39, 103, 106.
    acutus Kln., 39, 103, 106.
    adjunctus Kln., 39, 105, 106.
    admirabilis Kln., 39, 105, 106.
    adolescens Kln., 39, 104, 106.
    celsus Kln., 39, 102, 106.
    cereus Kln., 39, 103, 106.
    cicatricosus Kln., 39, 105, 106.
    circumscriptus Kln., 39, 105, 106.
    cyaneiventris Waterh., 39, 102, 106.
    dispar Kln., 39, 104, 106.

Leptotrichalus—Continued.
  dubitabilis Kln., 39, 103, 106.
  effeminatus Kln., 39, 105, 106.
  femoralis Kln., 39, 102, 106.
Lesticus Dej., 351.
  busuangae Heller, 351, 359.
  cupreatus Heller, 351, 359.
  gregori Kuntz, 351, 359.
  insignis Gestro, 351, 359.
  insignis var. philippinicus Kuntz, 351.
  mac-gregori Heller, 351, 360.
  prasinus Tchitch., 351, 360.
Leucobryaceæ, 279.
Leucobryum Hamp., 279.
  bowringii Mitt., 279.
  pentastichum Doz. & Molk., 279.
  sanctum Hamp., 279.
  scalare C. Müll. var. tjibodensis Fleisch., 279.
  sericeum Broth., 279.
Leucophanes Brid., 280.
  albescens C. Müll., 280.
  candidum (Hornsch.) Lindb., 280.
  octoblepharoides Brid., 280.
Libnetis Waterh., 71, 75.
  bardus Kln., 37, 72, 75.
  coloratus Kln., 37, 73, 75.
  commendabilis Kln., 37, 71, 72, 75.
  debilis Kln., 37, 72, 74, 75.
  deductus Kln., 37, 74, 75.
  defectus Kln., 37, 73, 75.
  gracillimus Kln., 37 72, 75.
Librestthis Schm. Goeb., 355, 358.
Limnophila (Ephelia) dietziana Alex., 373.
  (*Ephelia*) *subaprilina* Alex., 373, 380.
  (Ephelia) suensoni Alex., 373.
  (*Troglophila*) *cavernicola* Brun., 375.
Limoniinæ, 363.
Lioptera Chaud., 351.
  quadriguttata Chaud., 351, 360.
Lispinodes Sharp, 259, 263.
  heteroderes Fauvel, 263.
  rugosus Fauvel, 263.
  scriatus Fauvel, 263.
Loxocrepis Eschsch., 349, 358.
Luzonimyia Malloch, 491.
  nigropuncta Malloch, 491.
Lyciden der Philippinen-Inseln, 33.
Lycostomus Motsch., 43.
  flavolateralis, 46.
  flavotestaceus Kln., 36, 44, 45, 46.
  frivolus Kln., 36, 43, 45, 46.
  pygmaeus Kln., 36, 45, 46.
  similis Hope, 33, 36, 43, 46.
Lymnastis Motsch., 351, 358.
  pilosus Bates, 351, 360.
  setiger Sloane, 351, 361.
Lyropaeus Waterh., 77.
  philipppinensis Kln., 38, 78.

M

Macacus philippinensis, 2.
  rhesus, 2.
  syrichtus, 2.
Macrocheilus Hope, 351, 358.
  bensoni Hope, 352, 358.
  chaudoiri Andr., 351, 359.
  quadrimaculatus Guér., 352, 360.
  ruficollis Heller, 351, 360.
  trimaculatus Chaud., 351, 361.
  trimaculatus Oliv., 352.
  tripustulatus Guér., 352, 361.
  tripustulatus Redt., 352, 361.
Macromitrium Brid., 286.
  assimile Broth., 286.
  merrillii Broth., 286.
  reinwardtii Schwaegr., 286.
  rothostichum Nees, 286.
  salakanum C. Müll., 286.
  semipellucidum Doz. et Molk., 286.
  subuligerum, 286.
  sulcatum (Hook. et Grev.) Brid., 286.
Malacanthidæ, 219.
Malacanthus Cuv., 219.
  hoedtii Bleeker, 221.
  latovittatus Gthr., 220.
  latovittatus (Lacép.), 220.
  parvipinnis Vail. & Sauv., 221.
  taeniatus Cuv. & Val., 220.
Malayia Malloch, 510.
  fuscinervis Malloch, 511.
MALLOCH, J. R., Notes on Oriental Diptera, with descriptions of new species, 491.
Maraga Walk., 353, 358.
Megachelonus Baker, 454, 457, 487, 489.
  areolellus Baker, 458, 459, 461.
  bicoloricornis Baker, 453 458, 464.
  bidentatus Baker, 458, 459, 460, 462, 464.
  consociatus Baker, 459, 462.
  megacephalus Baker, 459, 462.
  rectangularis Baker, 458, 465.
  uniformis Baker, 453, 458, 464.
Megaristerus Nietn., 346, 358.
Megascogaster Baker, 454, 487.
  elongatus Baker, 488.
Meiothecium Mitt., 296.
  attenuatum Broth., 296.
  obtusum Broth., 296.
Melichthys, 533.
Metanoeus Waterh., 99.
  bakeri Kln., 39, 99, 100.
  cognatus Kln., 39, 100.
  fulvus Waterh., 100.
Meteoriaceæ, 288.
Meteoriopsis Fleisch., 289.
  reclinata (C. Müll.) Fleisch., 289.
Meteorium (Doz. & Molk.) Fleisch., 289.
  miquelianum (C. Müll.) Fleisch., 289.
Metriorrhynchus Guér. Men., 78, 81.
  böttcheri Kln., 38, 80, 81.
  croceus Kln., 38, 79, 80, 81.
  forcipatus Kln., 38, 79, 80, 81.
  philippinensis Waterh., 33, 38, 78–80, 82.
Meulen's catalytic method for the determination of nitrogen in organic compounds, 265.
Microchelonus Szepl., 452.

Microlestes Schm. Goeb., 352, 358.
  glabratus Redt., 352, 359.
Mirophallus Herre, 539.
  bikolanus Herre, 540.
Miscelus Klug, 352, 358.
  apicalis Brullé, 352, 358.
  celebensis Schauf., 352, 359.
  ceylonicus Chaud., 352, 359.
  convexicollis Putz., 352, 359.
  javanus Klug, 352, 359.
  javanus var. unicolor Putz., 352.
  morioformis W. MacL., 352, 360.
  paradoxus Putz., 352, 360.
  planatus Schauf., 352, 360.
  rufiventris Walk., 352, 361.
  stygicus Putz., 352, 361.
  vulneratus Putz., 352, 361.
Mitopeza Edwards, 379.
Mniaceæ, 284.
Mniodendron Lindb., 284.
  divaricatum (Reinw. et Hornsch.) Lindb., 284.
  korthalsii, 285.
Mnium (Dill.) L., 284.
  rostratum Schrad., 284.
Mochtherus Schm. Goeb., 352, 358.
  angulatus Schm. Goeb., 352, 358.
  quadrinotatus Motsch., 352, 360.
  retractus Walk., 342, 360.
  tetrasemus Dej., 352, 361.
  tetraspilotus MacL., 352. 361.
Molophilus **velvetus** Alex., **367.**
Morio Latr., 352.
  angustus Chaud., 352, 358.
  cordicollis Chaud., 352, 359.
  cucujoides Chaud., 352.
  cucujoides Walk., 352, 359.
  intermedius Chaud., 352, 359.
  luzonicus Chaud., 352, 360.
  orientalis Dej., 352, 360.
  subconvexus Chaud., 352, 361.
  submarginatus Chaud., 352, 361.
  trogositoides Walk., 352, 361.
  walkeri Putz., 352. 361.
Muscidæ, 494.
Muscinæ, 506.
Mycobacterium leprae, 116, 125, 128, 130, 135, 138.
Mydaea, 501.
  propinqua Stein, 498.
Myiospila, 499.
Myuriaceæ, 287.
Myurium, 287.
  foxworthyi, 287.

N

Nalagalep, 220.
Neckeraceæ, 289.
Neckeropsis Reichdt., 289.
  lepineana (Mont.) Fleisch., 289.
Nemophis Kaup, 224.
Neophanerotoma Szepl., 452.
Neostethus, 539.
Nesopeza Alex., 379.
Nestra Motsch., 354, 358.
Netuma, 394, 396.
  thalassina Bleeker, 407.
Nito, 389.

O

Oceanops Jordan & Seale, 219, 220.
  latovittatus Jordan & Seale, 220.
Ochromeigenia ormioides Townsend, 512.
OCHS, GEORG, Additional remarks on Philippine Gyrinidæ, 343.
Ochthephilus Nietn., 354, 358.
Ochthiphila luzonensis Malloch, 492.
Octoblepharum Hedw., 280.
  albidum (L.) Hedw., 280.
Odacantha Paykull, 352, 358.
  bimaculata Redt., 352, 359.
Odonus, 533.
Oodes Dej., 353.
  piceus Nietn., 353, 360.
  varians Chaud., 353, 361.
  vilus Chaud., 353, 361.
  virens Wied., 353, 361.
Ophidium tonkah-talawaree Russell, 224.
Ophionea Klug, 353, 358.
  bakeri Dupuis, 353, 358.
  bhamoensis Maindr., 353, 358.
Orectochilus, 343.
  discus Aubé, 343, 344.
  oberthüri Rég., 343.
  pulchellus Rég., 343.
  samarensis Ochs, **343**, 344.
  vitalisi Peschet, 344.
Oriental Diptera, with descriptions of new species, 491.
Orimargula Mik, 365.
  alpigena Mik, 365.
  flavella Alex., 365, **366.**
  flavella **fuscolineata** Alex., **366.**
Oropeza, 377.
  annulicornis, 377.
  candidipes Alex., 376.
  shirakiella Alex., **376.**
Orthogonius MacL., 353, 358.
  alternans Wied., 353, 358.
  duplicatus Bates, 353, 359.
  hypocrita Chaud., 353, 359.
  luzonicus Chaud., 353, 360.
Orthotrichaceæ, 286.

P

Pachauchenius W. MacL., 351, 358.
Pachytrachelus Chaud., 353, 358.
  angulatus F., 353, 358.
  ceylonicus Motsch., 353, 359.
  oblongus Dej., 353, 360.
  politus Schm. Goeb., 353, 360.
Palpostomini, 512.
Papillaria (C. Müll.) C. Müll., 288.
  fuscescens (Hook.) Jaeg., 288.
Paralispinus Bernh., 255.
  exiguus Er., 255.

Paralispinus—Continued.
  exiguus Er. var. obscuripennis Bernh., 255.
  exiguus Er. var. piceus Fauvel, 255.
  (Clavilispinus) siargaoanus Bernh., 255.
Paraphaea Bates, 346, 358.
Paraplotosus (Bleeker) de Beaufort, 387, 389.
  albilabris (Cuv. & Val.), 388.
  albilabris Weber and Beaufort, 388.
Parespeson Bernh., **261**.
Parigas, 389.
Pelekium Mitt., 292.
  velatum Mitt., 292.
Pentagonica Schm. Goeb., 353, 358.
  dichroa Sloane, 353, 359.
  pallipes Nietn., 353, 360.
  ruficollis Schm. Goeb., 353, 360.
  varicornis Heller, 353, 361.
Pentoplogenius Morow., 354, 358.
Pericalus MacL., 353.
  cicindeloides MacL., 353, 359.
  levifrons Heller, 353, 360.
  philippinus Heller, 353, 360.
  quadrimaculatus MacL., 354, 360.
  quadrisignatus Cast., 354, 360.
  undatus Chaud., 354, 361.
Peridinium, 395.
Perigona Cast., 354, 358.
  atriceps Fairm., 354.
  australica Sloane, 354, 358.
  beccarii Putz., 354, 358.
  discalis Chaud., 354, 359.
  fimicola Woll., 354, 359.
  jansoniana Woll., 354, 359.
  japonica Bates, 354, 359.
  livens Putz., 354, 360.
  luzonica Putz., 354, 360.
  nana Bates, 354, 360.
  nigriceps Dej., 354, 360.
  plagiata Putz., 354, 360.
  pusilla Péring., 354, 360.
  suffusa Bates, 354, 361.
  umbripennis Lec., 354, 361.
Perileptus Schaum, 354, 358.
  melas Jeann, 354, 360.
Peronomerus Schaum, 354.
  fumatus Schaum, 354, 359.
  nigrinus Heller, 354, 360.
Phallostethidæ, 538.
Phallostethus, 539.
Phanerotoma, 452.
Phanerotomini, 453.
Phaomusca Malloch, **503**.
  bakeri Malloch, **503**.
Phaonia, 503.
Phaoniinæ, 494.
Pheropsophus Solier, 354.
  agnatus Chaud., 354, 358.
  ambiguus Dej., 345.
  emarginatus Chaud., 354, 359.
  fimbriatus Chaud., 354, 359.
  fumigatus Dej., 354, 359.
  gironieri Eyd. & Soul., 354, 359.
Pheropsophus—Continued.
  interruptus Schm. Goeb., 354, 359.
  javanus Dej., 354, 359.
  occipitalis MacL., 345.
Philippine Carabidæ, 345.
  catfishes, order Nematognathi, 385.
  cricket-locusts (Gryllacridæ), 515.
  fishes, 533.
  Gyrinidæ, 343.
  Lycidæ, 33.
Philonotis Brid., 285.
  macrophylla Broth., 285.
  revoluta, 285.
  tjibodensis Fleisch., 285.
Phloeodromius W. MacL., 354, 358.
  fasciatus Chaud., 354, 359.
  hastatus Heller, 355, 359.
  sellatus Heller, 355, 361.
Physodera Eschsch., 355.
  davidis Fairm., 355, 359.
  dejeani Eschsch., 355, 359.
  eburata Heller, 355, 359.
  eschscholtzi Parry, 355, 359.
Pictia Malloch, **502**.
  xanthoceros Walk., 502.
Piestini, 245.
Pilotrichopsis Besch., 287.
  dentata (Mitt.) Besch., 287.
Pimelodus manillensis Cuv. & Val., 410.
Pithecus philippinensis Geoff., 2, 3, 24.
Plagiotheciaceæ, 294.
Plateros Bourg., 46, 61.
  bakeri Kln., 37, 56, 60.
  borneensis, 54, 56.
  conspiciendus Kln., 36, 53, 55, 56, 60.
  conspicuus Kln., 37, 56, 58, 60.
  constans Kln., 37, 54, 55, 56, 57, 60.
  contextus Kln., 36, 53, 54, 60.
  contiguus Kln., 37, 58, 60.
  continens Kln., 37, 57, 60.
  contortus Kln., 36, 47, 48, 49, 59.
  contrarius Kln., 36, 53, 54, 60.
  cuneatus Kln., 36, 50, 51, 52, 59.
  expletus Waterh., 47, 49.
  fraterculus Kln., 37, 58, 59, 60.
  fraudulentus Kln., 37, 57, 60.
  fucosus Kln., 36, 50, 59.
  fulgidus Kln., 36, 52, 60.
  generalis Kln., 36, 49, 59.
  lepidus Kln., 36, 49, 59.
  luteolus Kln., 36, 49, 59.
  luzonicus Kln., 36, 51, 52, 60.
  ordinarius Kln., 36, 47, 59.
  pilosus Kln., 36, 48, 59.
  ponderosus Kln., 36, 51, 59.
  popularis Kln., 36, 51, 52, 60.
  quadraticolis Kln., 37, 58, 60.
  senex Kln., 36, 48, 59.
  simillimus Kln., 36, 54, 60.
  tenebrans Kln., 36, 53, 58, 60.
  testaceus Kln., 37, 55, 60.
  triangulus Kln., 36, 54, 60.
Platymetopus Dej., 355.
  flavilabris F., 355, 359.

- Platymetopus—Continued.
    - flavilabris var. thunbergi Quens., 355.
    - laticeps Dej., 355, 360.
    - *obscuripes* Schauf., 355, 360.
    - *punctulatus* MacL., 355, 360.
- *Platynus* Steph., 347, 358.
- Pleuropus Griff., 292.
    - luzonensis Broth., 292.
- Plotosidæ, 386.
- Plotosus Lacép., 387, 389.
    - anguillaris (Bloch), 389, 391, 392.
    - *anguillaris* Cantor, 391.
    - *arab* Bleeker, 391.
    - canius Buch. Ham., 389, 390.
    - *castaneoides* Bleeker, 391.
    - *horridus* Bleeker, 390.
    - *ikapor* Lesson, 391.
    - *lineatus* Cuv. & Val., 391.
    - *macrophthalmus* Bleeker, 388.
    - *marginatus* Benn., 391.
    - *multiradiatus* Bleeker, 390.
    - *unicolor* Cuv. & Val., 390.
    - *viviparus* Bleeker, 390.
- Pogonatum Palis., 300.
    - *macrophyllum* Doz. & Molk., 300.
    - *microstomum* R. Br., 300.
    - spurio-cirratum Broth., 300.
    - wallisii (C. Müll.) Jaeg., 300.
- Pogonoglossus Chaud, 355, 358.
    - tagalus Heller, 355, 361.
- *Polietes*, 503.
- *Polystacus anguillaris* Bloch, 391.
- Polytrichaceæ 300.
- Pottiaceæ, 281.
- *Procautires*, 86.
- *Prometheus atlanticus* Lowe, 218.
- Promethichthys Gill, 217.
    - prometheus (Cuv. & Val.), 218.
    - *prometheus* Gill, 218.
- Protaphes Kln., 101.
    - confertulus Kln., 39, 101.
- *Pseudarius* Bleeker, 394, 396.
    - *philippinus* Sauv., 402.
- Pseudolimnophila inconcussa (Alex.), 380.
- Pseudolispinodes Bernh., 258.
    - latiusculus Bernh., 260.
    - longipennis Bernh., 259.
    - madurensis Bernh., 260.
    - sinuatus Bernh., 260.
- *Pseudoplagiotheciopsis philippinensis* Broth., 294.
- Pterobryaceæ, 287.
- Pterobryella, 287.
    - longifrons (C. Müll.) C. Müll., 287.
- *Pyrrhotachys* Sloane, 354, 358.

R

- Rare Philippine fishes, 217.
- *Rembus* Dej., 350, 358.
- Rhacelopus Doz. & Molk., 300.
    - pilifer Doz. & Molk., 300.
- Rhacopilaceæ, 287.
- Rhacopilum Palis., 287.
    - spectabile Reinw. & Hornsch., 287.
- Rhaphidostichum Fleisch., 296.
    - piliferum (Broth.) Broth., 296.
- Rhizogoniaceæ, 284.
- Rhizogonium Brid., 284.
    - spiniforme (L.) Bruch., 284.
- *Rhizopus*, 175.
- Rhodobryum (Schimp.) Hamp., 284.
    - giganteum (Hook.) Mitt., 284.
- *Rhogas*, 451.
- *Rhombodera* Reiche, 353, 358.
- Rhynchostegiella Limpr., 292.
    - edanoi Broth., 293.
    - mindorensis (Broth.) Broth., 292.
- Rhytidiaceæ, 299.
- *Rita*, 404, 405.
    - *manillensis* Gthr., 402.
- RODRIGUEZ, JOSÉ N., Studies on early leprosy in children of lepers, 115.

S

- Salts of linolenic hexabromide from lumbang oil., 441.
- Sambus auricolor Saunders, 244.
- SANTOS, JOSÉ K., Histological study of the bark of Alstonia scholaris R. Brown from the Philippines, 415.
- *Saronychium* Blackb., 350, 358.
- Scarelus Waterh., 77.
    - crudus Kln., 38, 77.
- Scarites F., 355.
    - *idus* Oliv., 345.
    - longiusculus Chaud., 355, 360.
    - *mancus* Bouch., 345.
    - *rugipennis* Chaud., 355, 361.
    - semirugosus Chaud., 355, 361.
- SCHEERER, OTTO, Batan texts with notes, 301.
- SCHÖBL, OTTO, and Andrew Watson Sellards, Experimental pneumonia in monkeys, 1.
- SELLARDS, ANDREW WATSON, *see* Schöbl and Sellards.
- Sematophyllaceæ, 294.
- Sigalphini, 453.
- *Sigalphus* Ill., 453.
- *Siltopia* Cast., 354, 358.
- Siluridæ, 386.
- *Simodontus picescens* Chaud., 345.
- SKVORTZOW, B. W., New Flagellata from North Manchuria, China, 229.
- SMITH, FREDERICK L., and AUGUSTUS P. WEST, Notes on Meulen's catalytic method for the determination of nitrogen in organic compounds, 265.
- *Spathinus* Nietn., 354, 358.
- *Sphaeropyx* Ill., 453.
- *Spilogaster xanthoceros* Walk., 502.
- Spiridens Nees, 285.
    - longifolius Lindb., 286.
    - reinwardtii Nees, 285.
- Spiridentaceæ, 285.
- Staphyliniden der Philippinen, 245.

Stenolophus Latr., 355, 358.
    cyanellus Bates, 355, 359.
    smaragdulus F., 355, 361.
    smaragdulus var. quinquepustulatus Wied., 355.
    stolidus Walk., 355, 361.
    transmutans Bates, 355, 361.
    trechoides Hope, 355, 361.
Stenotelus Bouch., 355.
    opacus Bouch., 355, 360.
Stereophyllum Mitt., 294.
    wightii (Mitt.) Jaeg., 294.
    (Moneurium) philippinense Broth., **294.**
Stomonoxus Motsch., 349, 358.
Strigoptera obsoleta Chevr., 235.
Subdihammatus Kln., 68.
    curvus Kln., 37, 68.
SUMULONG, MANUEL D., Congenital absence of both hind legs in an adult pig, 147.
Symphyodon Mont., 291.
    copelandii Broth., **291.**
Symphyodontaceæ, 291.
Symphyus Nietn., 350, 358.
Syrrhopodon Schwaegr., 280.
    albovaginatus Schwaegr., 280.
    amoenus Broth., 280.
    croceus Mitt., 280.
    mülleri (Doz. & Molk.) Lac., 280.
    revolutus Doz. & Molk., 280.
Systenognathus Putz., 353, 358.
? Systolocranius Chaud., 355.
    grandis Dej., 355, 359.
    linea Wied., 355, 360.
    sulcatus Eschsch., 355, 361.

T

Tabangongo, 394.
Tabanko, 394.
Tachinidæ, 508.
Tachys Steph., 356.
    albicornis Schaum., 356, 358.
    anceps Putz., 356, 358.
    atriceps W. MacL., 357, 358.
    barringtoni Andr., 356, 358.
    ceylanicus Nietn., 356, 359.
    coracinus Putz., 356, 359.
    doddi Sloane, 356, 359.
    dohertyi Jord., 356, 359.
    emarginatus Nietn., 356, 359.
    euglyptus Bates, 356, 359.
    extremus Walk., 357, 359.
    feanus Bates, 356, 359.
    flaviculus Motsch., 356, 359.
    fumigatus Motsch., 356, 359.
    haliploides Bates, 356, 359.
    imperfectus Andr., 356, 359.
    impressipennis Motsch., 356, 359.
    infans Bates, 356, 359.
    klugi Nietn., 356, 360.
    klugi var. sulcatopunctatus Putz., 356.
    latissimus Motsch., 356, 360.
    mirabilis Bates, 356, 360.
Tachys—Continued.
    mirandus Dup., 356, 360.
    nietneri Schaum., 357, 360.
    orientalis Nietn., 356, 360.
    ornatus Apetz., 356, 360.
    ovatus Motsch., 356, 360.
    parallelus Motsch., 357, 360.
    pictipennis Putz., 357, 360.
    plagiatus Putz., 356, 360.
    plagiatus var. longulus Andr., 356.
    pulcher Andr., 356, 360.
    punctus Andr., 356, 360.
    punctus var. variabilis Andr., 356.
    quadrillum Schaum., 357, 360.
    quadrillum var. impictus Andr., 357.
    remotiporis Bates, 356, 360.
    serratus Andr., 357, 361.
    sinuaticollis Sloane, 356, 361.
    spilotus Bates, 357, 361.
    sulculatus Putz., 356, 361.
    trechiformis Jord., 357, 361.
    triangularis Nietn., 357, 361.
    truncatus Nietn., 357, 361.
    umbrosus Motsch., 357, 361.
Tambongongo, 394.
Taphes Waterh., 101.
    acceptus Kln., 39, **101.**
Taraktogenos kurzii (King), 162.
Tauti, 389.
Taxithelium Spruc., 297.
    capillipedi Broth., 298.
    divergens Broth., 298.
    instratum (Brid.) Broth., 297.
    nepalense (Schwaegr.) Broth., 297.
    percapillipes Broth., 297.
    robinsonii Broth., 298.
    (Polystigma aptera) agentatum Broth., **297.**
Temperature and moisture, relation of, to diseased and disease-free corn, 169.
Tenuia Malloch, **493.**
    nigripes Malloch, **493.**
Tetrapleurus Bernh., 262.
    bakeri Bernh., 262, **263.**
    banghaasi Bernh., **263.**
    banosanus Bernh., **263.**
    indicus Bernh., 262.
    opacus Bern., **263.**
    splendidus Bernh., **263.**
Teuay, 221.
Thenarotidius Sloane, 346, 358.
Thlibops Putz., 357.
    abbreviatus Heller, 357, 358.
    glabriventris Heller, 357, 359.
    integricollis Heller, 357, 359.
    intermedius Heller, 357, 359.
    minor Heller, 357, 360.
    omega Heller, 357, 360.
Thoracochirus Bernh., 254.
    minutissimus Bernh., **255.**
    nanus Heller, 255.
    raffrayi Fauvel, 254.
    variolosus Fauvel, 254, 255.

- Thoracochirus—Continued.
  - *variolosus* var. *foersteri* Bernh., 255.
  - variolosus var. **intermedius** Bernh., **255.**
  - variolosus var. **sublaevicollis** Bernh., **255.**
- Thoracophorus Motsch., 260.
  - *alluaudi* Fauvel, 261.
  - brevicristatus var. deletus Fauvel, 260.
  - **longipennis** Bernh., **260.**
  - **minutissimus** Bernh., **261.**
  - **philippinus** Bernh., **261.**
- **Thryptodexia** Malloch, **509.**
  - **polita** Malloch, **509.**
- Thuidiaceæ, 292.
- Thuidium, 292.
  - cymbifolium (Doz. & Molk.), 292.
  - glaucinoides Broth., 292.
  - investe (Mitt.) Jaeg., 292.
  - meyenianum (Hamp.), 292.
  - tamariscellum (C. Müll.), 292.
- *Thymedes*, 236.
- Thyridium Mitt., 280.
  - constrictum (Sull.) Mitt., 280.
- *Thyrsites prometheus* Gthr., 218.
- Thysanomitrium Schwaegr., 277.
  - blumii (Doz. & Molk.) Broth., 277.
  - subexasperatum (C. Müll.) Broth., 278.
- *Tinea alba*, 116.
- *Tipula acifera*, 378.
  - *aino* Alex., 380, 381.
  - **cylindrostylata** Alex., **378.**
  - *insulicola* Alex., 378.
  - *kuzuensis* Alex., 380.
  - *nikkoensis* Alex., 378.
  - *nipponensis* Alex., 378, 380.
  - *querula* Alex., 378, 379.
  - *sparsiseta* Alex., 378.
  - **yamamuriana** Alex., 379, 380.
  - *yamata* Alex., 380.
- Tipulidæ from eastern Asia (Diptera), 363.
- Tipulinæ, 376.
- Trachelomonas acanthostoma Stokes, 231.
  - armata (Ehrbg.) Stein, 231.
  - armata (Ehrbg.) Stein var. **brachycentra** Skvortzow, **231.**
  - armata (Ehrbg.) Stein var. **rigens** Skvortzow, **232.**
  - armata (Ehrbg.) Stein var. **rotunda** Skvortzow, **231.**
  - arnoldiana Skvortzow var. **manchurica** Skvortzow, 230.
  - baikovi Skvortzow var. **punctata** Skvortzow, 230.
  - crebea Kellicott var. **punctata** Skvortzow, 232.
  - depressa, Swirenko var. punctata Skvortzow, 229.
  - *helvetica* Lemmermann var. *armata* Skvortzow, 232.
  - heterospina Swirenko var. **armata** Skvortzow, 232.
  - hispida (Petry) Stein var. crenulatocollis (Maskell) Lemmermann, 232.
- Trachelomonas—Continued.
  - ianczowskii Drezepolskii, 232.
  - ianczowskii var. **decorata** Skvortzow, **232.**
  - intermedia Dangeard, 232.
  - kelloggi Skvortzow var. **coronata** Skvortzow, **229.**
  - kelloggi Skvortzow var. **punctata** Skvortzow, 229.
  - nobilis Skvortzow var. **paludosa** Skvortzow, 231.
  - oblonga Lemmermann, 231.
  - oblonga var. punctata Lemmermann, 231.
  - orienburgica Swirenko var. **hypacantha** Skvortzow, **231.**
  - plantonica Swirenko var. **kozlovi** Skvortzow, 230.
  - *pulchra* Swirenko var. *bispinosa* Skvortzow, 232.
  - pulchra Swirenko var. **punctulosa** Skvortzow, 230.
  - raciborskii Woloszynska var. punctata Skvortzow, 230.
  - teres Maskell var. **glabra** Skvortzow, 231.
  - volvocina Ehrbg., 229.
  - wislouchi Skvortzow, 230.
  - wislouchi Skvortzow var. **collaris** Skvortzow, 230.
  - wislouchi var. **glabra** Skvortzow, **230.**
- Trachyloma Brid., 288.
  - *indica* Mitt., 288.
  - papillosum Broth., **288.**
- *Trachypetus* Guér. 452, **453.**
- Trachyphyllum Gepp., 293.
  - inflexum (Harv.) Gepp., 293.
- Trachypodaceæ, 288.
- Trachypus Reinw. & Hornsch., 288.
  - hispidus C. Müll. 288.
- Trachythecium Fleisch., 299.
  - verrucosum (Hamp.) Fleisch., 299.
- *Trechicus* Lec., 354, 358.
- Trechodes Blackb., 357.
  - bakeri Jeann., 357, 358.
- Trechus Schellenb., 357, 358.
  - bakeri Jeann., 357, 358.
- Trematodon Michx., 277.
  - acutus C. Müll., 277.
  - drepanellus Besch., 277.
- *Triaspis* Hal., 453.
- Trichalus Waterh., 107.
  - **absonus** Kln., 39, **108**, 109.
  - **clypeatus** Kln., 39, **107**, 109.
  - **costillis** Kln., 39, **108**, 109.
  - *cyaneiventris* Waterh., 33.
  - longicollis Bourg., 33, 39, 107.
  - nigricauda Bourg., 33, 39, 107.
- Trichosteleum (Mitt.) Jaeg., 296.
  - boschii (Doz. & Molk.) Jaeg., 296.
  - hamatum (Doz. & Molk.) Jaeg., 296.
  - hamatum (Doz. & Molk.) Jaeg. var. semimamillosum (C. Müll.) Par., 296.
- Trichostomum Hedw., 282.
  - *cylindrica* (Bruch) C. Müll., 283.
  - (Oxystegus) **atrovirens** Broth., **282.**

- *Trichothorax* Montr., 353, 358.
- Trigonotoma Dej., 357.
  - leotaudi Tchitch., 357, 360.
  - luzonica Chaud., 357, 360.
  - palawanica Tchitch., 357, 360.
- Trismegistia (C. Müll.) Broth., 295.
  - densiretis Broth., 295.
  - lancifolia (Harv.) Broth., 295.
  - lancifolia (Harv.) Broth. var. korthalsii (Doz. & Molk.) Fleisch., 295.
  - prionodontella (Broth.) Broth., 295.
  - rigida (Hornsch. & Reinw.) Broth., 295.
- Troglophila Brun., 373, 374.
  - cavernicola (Brun.), 374, 375.
  - filicornis (Alex.), 374.
  - monticola Edwards, 374.
  - seticornis Alex., 374, 375.
- Troglophilus Krauss, 374.

V

- Vesicularia (C. Müll.) C. Müll., 299.
  - meyeniana (Hamp.) Broth., 299.
- VIBAR, TORIBIO, The relation of temperature and moisture to diseased and disease-free corn, 169.

W

- Wakefieldia Br., 353, 358.
- Warburgiella C. Müll., 296.
  - cupressinoides C. Müll., 296.
- Webera Hedw., 283.
  - scabridens (Mitt.) Jaeg., 283.
- Weisia Hedw., 281.
  - edentula Mitt., 281.
- WEST, AUGUSTUS P., *see* IMPERIAL and WEST; *see also* HERRERA-BATTEKE and WEST; *see also* SMITH and WEST.
- Wilsoniella C. Müll., 277.
  - acutifolia Broth., 277.

X

- Xenosina Malloch, 505.
  - *pudica* var. *rufomarginata* Malloch, 505.
- Xenosina—Continued.
  - *rufomarginata*, 505.
  - siamensis Malloch, 505.
- *Xenothorax* Woll., 353, 358.
- Xiphasia Swainson, 224.
  - setifer Swainson, 224.
- Xiphasiidæ, 223.
- *Xiphogadus* Gthr., 224.
  - *setifer* Gthr., 224.
- Xylobanus Waterh., 86.
  - barbarus Kln., 38, 90, 92, 98.
  - basilensis Kln., 38, 93, 99,
  - bellus Kln., 38, 92, 98.
  - benignus Kln., 38, 87, 88, 91, 98.
  - bicoloratus Kln., 39, 96, 99.
  - blandus Kln., 38, 86, 98.
  - brevis Kln., 38, 89, 90, 91, 98.
  - caelestis Kln., 38, 89, 91, 98.
  - canaliculatus Kln., 38, 91, 98.
  - candidus Kln., 39, 94, 99.
  - *clandestinus*, 95.
  - consentaneus Kln., 39, 88, 94, 95, 96, 99.
  - consimilis Kln., 38, 88, 93, 97, 98.
  - consobrinus Kln., 38, 88, 89, 98.
  - consociatus Kln., 39, 97, 98, 99.
  - fragilis Kln., 39, 93, 96, 99.
  - lanatus Kln., 38, 87, 88, 98.
  - luzonicus Kln., 39, 95, 97, 99.
  - nitidus Kln., 38, 88, 98.
  - paululus Kln., 39, 93, 94, 99.
  - pubens Kln., 38, 89, 98.
  - pudicus Kln., 39, 95, 99.
  - pullatus Kln., 39, 94, 99.
  - quadratus Kln., 38, 92, 93, 98.

Y

- YASUYAMA, K., Some factors influencing, in vivo, the result of the globulin precipitation test, 431.

Z

- Zenarchopterus cagayensis Herre, 537.
- Zuphiolum Fairm., 351, 358.